# THE MODEL ENGINEER

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# THE MODEL ENGINEER

EVERY THURSDAY

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### Our Cover Picture

At the Andover Traction Engine Rally, which is described and illustrated elsewhere in this issue, one of the most intriguing exhibits was the White "Locomobile" steam car depicted on our cover this week. This remarkable old vehicle dates from 1903 and is owned by Mr. D. Blackford, of Calne, Wilts. It has a flash steam generator under the front seat, a 2-cylinder compound engine under the bonnet, and drives directly on to a propeller shaft, with no gearbox or clutch. Mr. Blackford says that he has run at 45 m.p.h. on it, and that there is sufficient capacity for petrol fuel and water to enable the car to make a non-stop trip of 100 miles. It runs remarkably smoothly and handles very well. The photograph shows that, in spite of its 51 years, it is in almost perfect condition; in fact, it put to shame some of the very much younger cars to be found in the car-park !

# SMOKE RINGS

### "M.E." Exhibition Reminder

TIME IS passing quickly towards the "M.E." Exhibition, and we are glad to report that enquiries for Competition entry-forms have been numerous and many forms have been sent out. The earlier that these forms are returned to our Exhibition Manager the easier it is for us in making all our arrangements in preparation for the exhibition; in any case, Monday, July 12th is the deadline, and we prefer, of course, that all the entry-forms do not come in, as a sort of avalanche, on that day !

We would remind all prospective competitors, therefore, to return their entry-forms, duly filled in, with as little delay as possible; also, we are especially anxious to receive photographs of models that will be entered at the show. Prints should be clear and sharp, preferably not smaller than postcard size. If there should be any difficulty in forwarding prints, of this size or larger, then the negatives should be sent, so that we can make our own prints.

### Paddington Station Centenary

THERE WERE no special public celebrations to mark the precise centenary of Paddington Station, but one cannot help feeling some admiration for the foresight of I. K. Brunel and his architect, Matthew Digby Wyatt, who were responsible for the original plans. It was on May 29th, 1854, that the present station was first brought into use, and with only comparatively minor alterations it has sufficed for the traffic needs of, first the Great Western Railway and, since 1948, the Western Region of British Railways, ever since. Until 1909, the station, architecturally, was unique, at least among the London termini, in that the main hall, under the three arched spans of roof, was treated as a single design; moreover, to this day, the architectural details are not like those of any other railway station, but are entirely distinctive and wholly "Paddington."

For more than three generations, the station has enjoyed the popularity of a large section of the travelling public, many of whom still regard it, with affection, as the "Gateway to Honeymoon Land." During the late war, part of the station received severe bomb damage; but so skilfully were the repairs carried out, that few people today would be able to detect where the damage occurred.

The number of famous locomotives that have passed into and out of Paddington since 1854 tots up to a goodly total that would be difficult to equal, let alone surpass, elsewhere; and we doubt whether Paddington's catalogue of celebrated passengers could be matched at any other railway station in the world.

### Our Efforts were Hopeless

WE LATELY received a letter from a reader who appealed to us for help in what was obviously an urgent matter. We could probably have solved his problem, *but*—and this is the astounding thing—his letter bore no address; there was no self-addressed envelope and not even a stamp for a reply.

In view of the clear urgency of the matter, however, we consulted our Subscribers' List, but there was no trace of our correspondent's name in it. We looked up the envelope in which his letter had come, and found that it bore the "Reading, Berks" postmark; so we got through to the Reading Telephone Exchange and, after some delay, again drew a blank. There was nothing else we could do, and we fear that somewhere in or near the Reading area, there is an agitated individual thinking unprintable thoughts about us—and through no fault of ours !

Unfortunately, this is by no means an isolated case.

# The Andover Traction Engine Rally

*The Tug-o'-War between two Foden steam wagons.*

FOR most of upwards of 2,000 people who found their way to Finkley Manor Farm, near Andover, Hants., May 1st, 1954 will be remembered for a long time. For an interesting collection of steam locomotives and tractors, as well as two old motorcars, had been brought together to take part in a rally organised by the Andover & District Society of Model Engineers, who deserve full marks for the energy and enthusiasm so obviously put into all the arrangements. The weather, unlike that at the previous rally in 1953, was good, if cold and windy; but, after several rainless weeks, the ground was as hard as a board.

First, there was a kind of grand parade in which all the engines formed into a sort of procession which traversed the "race-course" that had been marked out in the big field; one at a time, they passed by the admiring crowds and created much enthusiasm. During this time, and as each engine became available for inspection, three judges, Messrs. J. Box, S. Watson and J. N. Maskelyne had the difficult task of deciding which one was to receive the prize in the "Elegance" Contest. The decision went in favour of the magnificent Fowler Scenic Showman's Engine, *Lion*, owned by Mr. E. A. Lucas of Salisbury; this engine is beautifully maintained, absolutely complete and in first-class condition, almost as good as she was when built in 1932.

The prize for the General-Purpose Tractors was not so difficult to award, since Mr. Arthur Napper's *Oldtimer*, a Marshall, No. 37690, was the only entry in that class! But all the same, the judges decided to withhold the prize until they had seen what *Oldtimer* could *do*! The Obstacle Race for General-Purpose tractions was, therefore, run in spite of only one entry; and this caused much amusement. *Oldtimer*, alone, successfully dodged every obstacle on the course and ran it in a remarkably short time, to the great delight and acclamation of the spectators. The judges duly awarded the prize! It is scarcely necessary to add that, thereafter, *Oldtimer*, was generally regarded as the heroine of the afternoon! In addition, she was awarded a prize for the tip-top condition in which she was turned out; for, if reports are to be trusted, she was about the oldest thing in the field, though few would have thought it.

Another event that caused much hilarity was a tug-of-war between two Foden tractors. For several minutes, these two coupled back-to-back by chain, endeavoured to gain control of the situation; but neither would give way to the other, and the contest was declared a dead-heat, though many spectators were left to wonder what would have happened if the chain had broken.

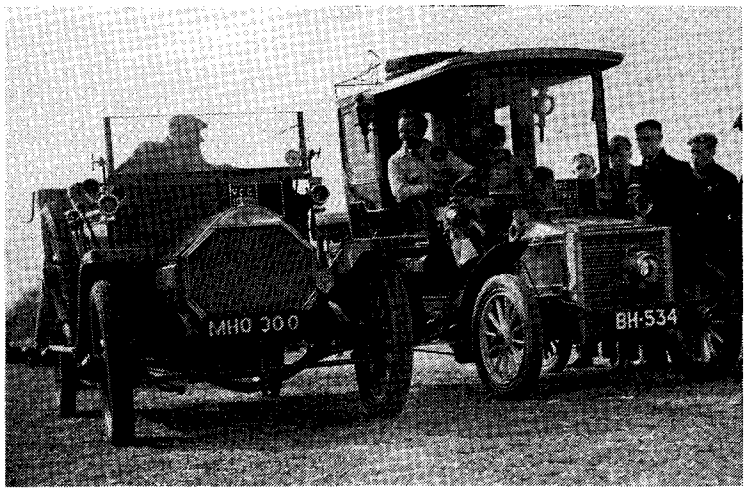
The programme extended to ten events and lasted for nearly three hours; but there was not a single mishap, and the interest and enthusiasm of the spectators were un-

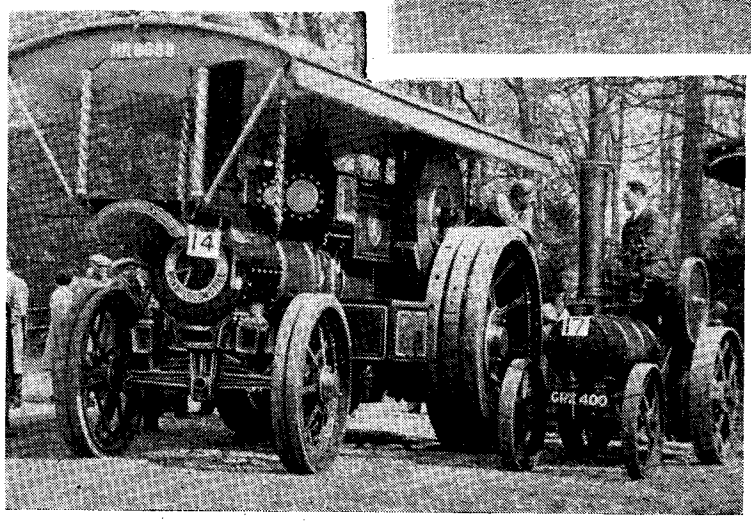
*Some of the engines lined up for the Grand Parade. Two of the judges, J. Box and S. Watson, are on the right; the third, J.N.M. took the photograph*

flagging throughout the proceedings. We cannot spare space in which to describe every event, but it is worthy of note that there were no fewer than eighteen exhibits on the field. Apart from those already mentioned, they included two splendid Burrell Scenic engines, Sentinel steam wagons, an Aveling & Porter steamroller, Marshall, Garrett, Foden, Wallis & Steevens and Burrell agricultural engines and a Garrett showman's tractor which deserves some special mention. She is named *Victoria* and was illustrated in THE MODEL ENGINEER, July 31st, 1947, from a photograph by Mr. W. Boddy, who discovered her lying abandoned and derelict in a farmyard at Eversley, near Reading. At that time, it was thought she would never run again; but somebody rescued her and, thanks to her present owner, Mr. D. Marder, she is in fine form. A particular point of interest about her is that she is fitted with piston-valves.

The two old cars were objects of great interest to many spectators, and they contrasted strikingly with the modern, and not-so-modern, cars parked on the field. One was a White steam car, built 1903, and the other a Humber dating from 1909; both were in near-perfect condition and ran well.

A separate marquee housed a fine collection of models, the work of members of the Andover and neighbouring model engineering societies, who certainly seem to know how to put on an attractive and convincing show. Mr. Bartlett's 7¼-in. gauge *Royal Scott* locomotive was doing yeoman service on about 100 yards of track nearby.






*Above*: *Mr. J. M. Reid, in his* 1909 *Humber, passes the time of day with Mr. D. Blackford in his* 1903 *White steam car*

*Below*: *Mr. S. J. Wharton's Burrell Showman's engine, "King George VI," in the Grand Parade*

*Left*: *Dignity and Impudence! Mr. R. Corbett's Burrell Showman's engine and Mr. G. Romanes's 3-ton Wallis & Steevens tractor "Goliath" make an interesting contrast*

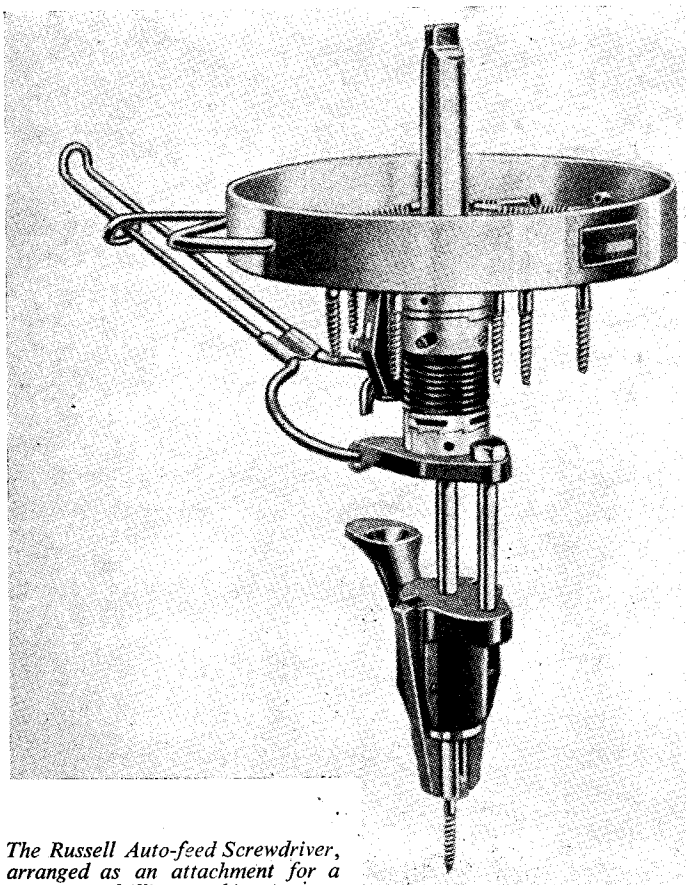
# BRITISH INDUSTRIAL PROGRESS

## SOME IMPRESSIONS OF THE 1954 BRITISH INDUSTRIES FAIR

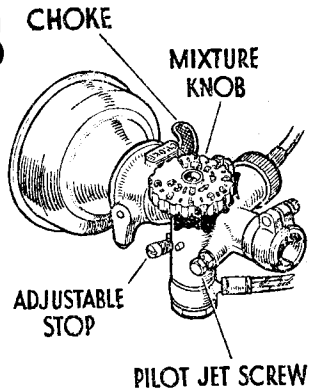
THE challenge of increasing competition in world markets makes it more than ever necessary for manufacturers in this country to study not only ways of increasing production and maintaining quality, but also improving design, and exploring the possibility of opening up entirely new markets by introducing new inventions and innovations. It may be said that one of the most notable features in this year's British Industries Fair is the accent on novelty—and not novelty for its own sake, but with a definite and useful purpose. In view of the vast size of the Fair, and the enormous range of the products exhibited, it would be impossible within the scope of a brief review to mention more than a minute proportion of them, and the items described here are selected at random in the all too limited time available in a one-day tour of the Birmingham section of the Fair.

**Portable Power Appliances**

The tendency to apply mechanical power to duties and operations formerly handled by manual or animal power continues to grow,



*The Russell Auto-feed Screwdriver, arranged as an attachment for a drilling machine*




*The suction carburettor employed on the 70 c.c. Villiers industrial engine*

and many interesting new developments in light and heavy tractors, excavators, bulldozers, cranes, etc., were to be seen, also light cultivators and other agricultural appliances. These naturally give scope for the application of small-power petrol engines, and nearly all the latter are now of the air-cooled type, running at fairly high r.p.m., and thus light and compact for the duty they have to perform. Of special interest in this respect were the engines by Villiers, Brockhouse, and the Wolseley Sheep Shearing Machine Co. The products of the first-mentioned are so well known, both in the industrial and motor-cycle fields, as to call for little comment, but one of their latest products deserves to be mentioned here. This is a 70 c.c. two-stroke, already popular for driving lawn-mowers and similar purposes; it is arranged in a near-horizontal position, and is equipped with a flywheel magneto and a suction carburettor, the latter fed from a shallow rectangular tank mounted on the engine base. This engine, classed as the 4G, has a bore of 43 mm. and a stroke of 48 mm. and develops 0.55 h.p. at 3,000 r.p.m.

The Brockhouse Engineering (Southport) Ltd. exhibited two engines, one being a four-stroke of 248 c.c. (64.5 mm. bore by 76 mm. stroke), with a power output of 3 h.p. at 2,500 r.p.m., and a two-stroke of 123 c.c. (56 mm. bore by 50 mm. stroke) with a power output of 1 h.p. at 3,000 r.p.m. The Wolseley Sheep Shearing Machine Co., in addition to a range of industrial air-cooled four-strokes in various sizes exhibited some ingenious power-driven agricultural appliances, and equipment for electrified fences, operated by battery and coil.

*The " Supa-dynamic " power tool, with accessories and " power pins "*

**A Portable I.C. Turbine**

An entirely new departure in portable power units was the 60 b.h.p. industrial turbine produced by Rover Gas Turbines Ltd., who are well known as pioneers in the development of the original turbo-jet reaction engine. This has a power output of 60 h.p., and the weight of the bare engine is 116 lb., giving a power/weight ratio of 1.93 lb./b.h.p. The engine is of the single-shaft type, that is to say, the turbine rotor and the compressor are mounted on opposite ends of the same shaft, from which the primary power drive is also taken to a reduction gear. A single-stage, single-sided centrifugal compressor is employed, with 17 blades and nine diffuser (stationary) blades. Air is discharged from the compressor to a return-flow combustion chamber, into the inner casing of which fuel is injected and ignited, by means of a high-tension spark; the combustion gases, together with excess air, then pass through 21 nozzles to a single-stage impulse turbine having 31 blades, after which they are exhausted at low pressure. The rotor speed is 46,000 r.p.m., and reduction gearing can be arranged to suit the particular requirements. It is necessary to run the rotor up to a high speed for starting, and this can be done either by hand gearing or an electric motor.

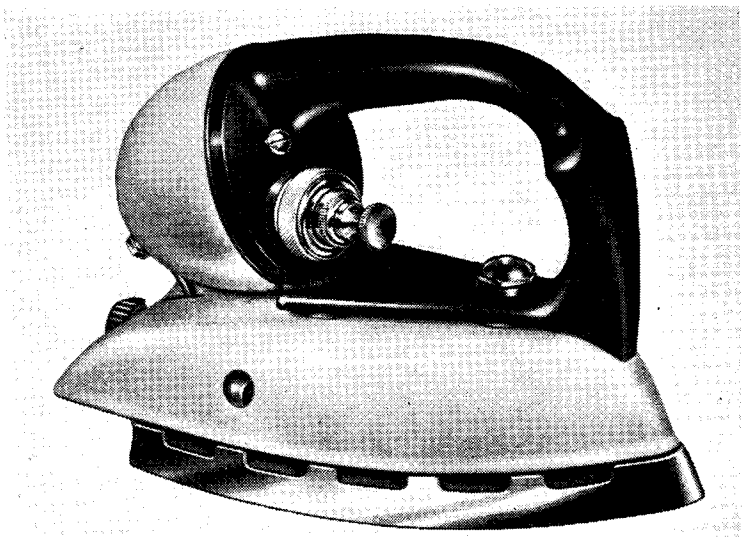
**Power and Hand Tools**

Many new and ingenious devices were to be seen in this section. Messrs. S. N. Bridges & Co. Ltd. exhibited some new power tools for wood and metal working, including a light and powerful electric hand drill which can be applied as a power unit for other multi-purpose tools. The well-known Wolf Electric tools were also featured, also the Desouter electric and pneumatic tools, flexible shaft tools by B. O. Morris Ltd., and universal woodworking tools by the Coronet Tool Co.

A very ingenious device for driving either wood or metal thread screws was exhibited by Russell Auto-feed Screwdrivers Ltd., being available either as a complete power-driven machine or as an attachment for an existing drilling machine. It is designed to run at a spindle speed of about 600 r.p.m., and incorporates a magazine which is oscillated by means of an eccentric, so as to sort and arrange the screws, right way up, ready for delivery to a nozzle which conveys them to the assembly position. As one screw is being driven, another is automatically fed down ready to drop into place when the feed lever is withdrawn. The screwdriver is driven by means of an adjustable torque-limiting clutch, so that any degree of tightness can be obtained, and kept uniform.

It is thus possible to insert and drive screws just by moving the feed lever up and down, as quickly as the operator can bring the work in position. Provision is also made for fitting washers on the screws where required.

The " Supa-Dynamic " power tool opens up new possibilities for speeding up building and structural engineering by firing special nails into brickwork, masonry, concrete or metal by means of an explosive charge. It operates in either of two ways; by applying the force of the propellant directly on the head of the nail or through the medium of an intermediate piston, which can be used to control depth of pene-

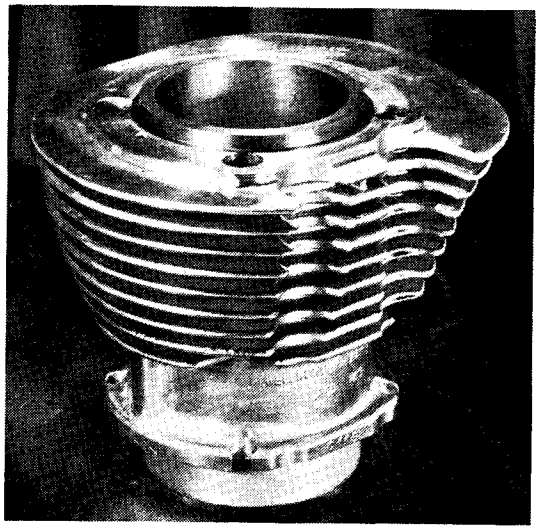


*The Tilley paraffin-heated flat iron, with pressure reservoir and air pump in handle*

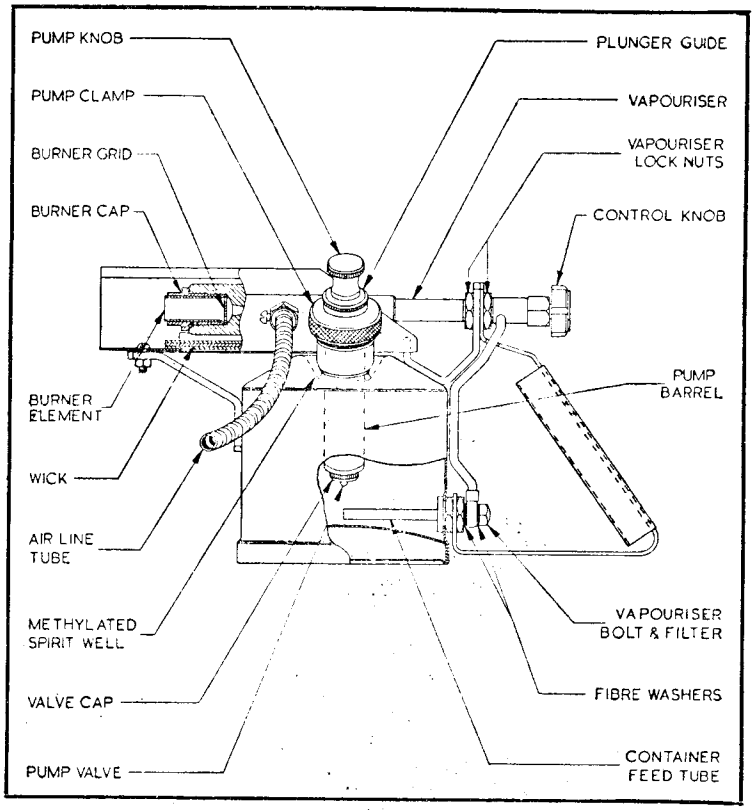
tration, or as a forming or crimping device to increase the security of the fixing. The nail, which is referred to as a " power pin " is loaded into the muzzle of the tool, being centrally located by a plastic ring or fibre washer, which also serves to prevent the escape of gas pressure. A cartridge is inserted in the breech, which is then closed; the tool is then placed against the material in which the pin is to be inserted, and located with the aid of marks on the nose of the tool, which can be aligned with cross centre lines previously marked out on the work. As a safety precaution, the tool cannot be fired unless it is pressed tightly against a hard surface, after which, depression of the button in the handle releases the firing pin. Very little noise, and practically no smoke, are produced, but the explosion produces a force much greater than can be obtained by means of a hammer or other known hand tool. A 0.22 calibre cartridge is used for pins up to $\frac{5}{16}$ in. diameter, and a 10 mm. cartridge for large pins up to $\frac{1}{2}$ in. diameter.

**Heating Appliances**

The Tilley Lamp Co. Ltd., who are well known for their high-power incandescent lamps, exhibited in addition some other items which are interesting from the technical aspect, and applicable both to domestic and industrial use. This applies to their new convector heater, which is suitable for either home or factory heating; it burns paraffin in a gravity-feed wickless burner, which requires neither pumping nor trimming, and produces from 2,000 to 6,250 B.Th.U. per hour. A paraffin-heated domestic flat iron made by this firm employs a vaporising burner, the fuel tank and air pump for which is built into the handle; another new device is a blowlamp burning alcohol, which is adaptable as a leak detector for refrigerators using methyl chloride or the Freon group of refrigerants.



*An example of an aluminium cylinder with bonded liner, produced by the Al-fin process*




*The Tilley alcohol blowlamp, equipped with intake tube for use as a leak detector for refrigerators*

**Industrial Processes**

Quite a number of firms featured models or illustrations which gave an insight into the progress which is being made in production methods and industrial processes. Most of these dealt with extraction and refining of basic materials, including oil and various chemicals. A process of direct interest to engineers, and one which has already had its effect on improving the efficiency of petrol engines, is the Al-fin bimetallic bonding process by Wellworthy Ltd., best known as manufacturers of piston rings. By this method, aluminium alloys can be cast on to ferrous components such as cylinder barrels, in such a way as to produce a perfect metallic bond, giving the highest possible thermal and electrical conductivity. This enables air-cooled engines to transmit and dissipate a much greater amount of heat than is otherwise possible, and thereby to achieve higher sustained power output.

As already mentioned, this review does no more than skim the surface of the enormous range of goods exhibited at the B.I.F., but it should at least provide evidence that there is no lack of initiative or inventive genius in the manufacturing industries of this country.

# AN INTERNAL KEYWAY CUTTER

## By "Duplex"

THE commercial method of cutting internal keyways, by means of either a slotting machine or suitable broaching equipment, is hardly likely to be adopted in the small workshop for lack of the necessary tools. The old-time way of forming these keyways, with cold chisel and file, calls for the skilful use of hand tools, and is not much in favour in the present machine age, but we can recall occasions on which this was, in the circumstances, the only way of getting the work done.

In previous articles, we have described cutting internal keyways in pulleys and collars by adapting the lathe to serve as a hand-operated shaping machine; this method, although somewhat laborious, has the advantage that two or more keyways can be accurately spaced by indexing the work from the lathe mandrel.

However, if the workshop is equipped with either a hand or a power shaping-machine, a single keyway can be readily cut to a high degree of accuracy.

A job of this kind was done recently in the shaping machine when making a two-step belt pulley for an electric motor. Here, a keyway, $\frac{3}{16}$ in. wide, $\frac{1}{8}$ in. deep, and $1\frac{7}{8}$ in. in length, was cut in the bore, measuring $\frac{5}{8}$ in. in diameter.

### Making the Tool

The special tool required for this purpose is best made in two parts: the shank, and the arm with its inset cutter-bit. The arm should be of as large a diameter as possible in order to avoid springing under the pressure of the cut; this part is made a light press-fit in the shank, and is secured with a nut. The size of the shank will, of course, depend on the capacity of the machine's tool-holder, but robust construction is advisable to maintain rigidity.

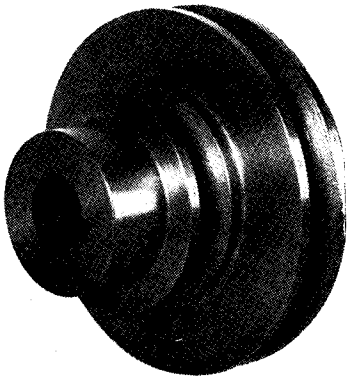


*Fig. 1. The finished pulley*

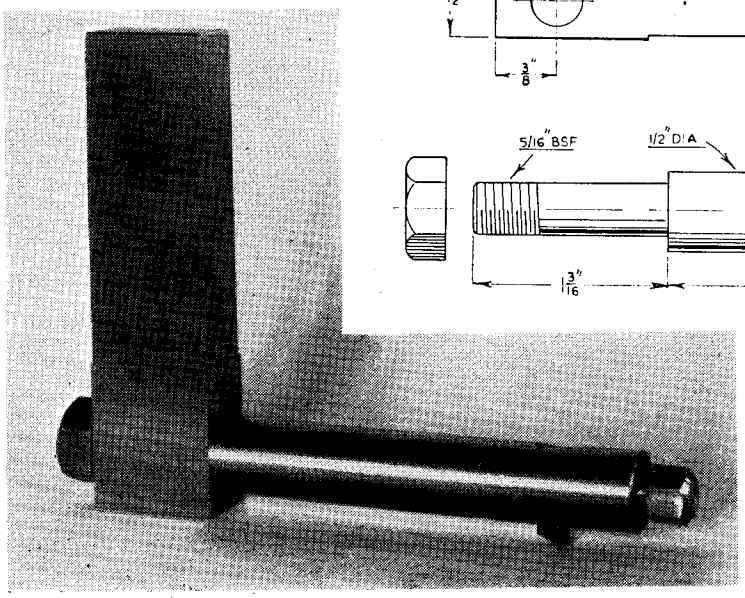


*Fig. 2. The internal keyway cutting tool*

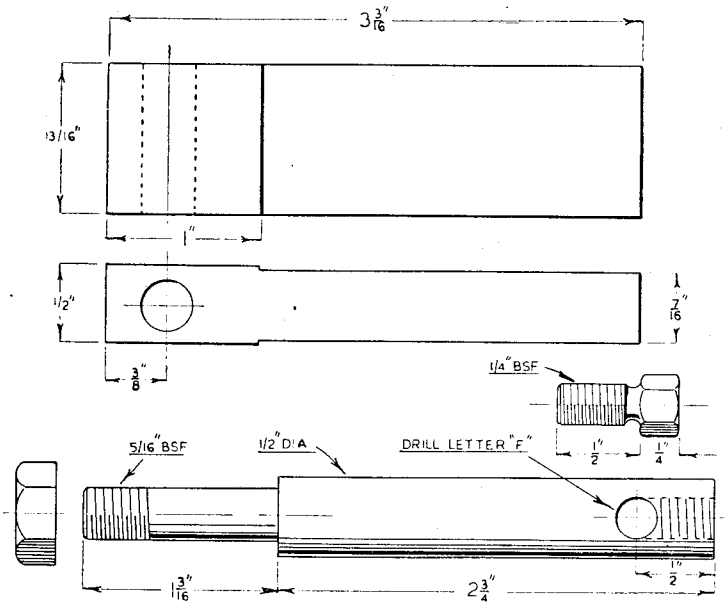



*Fig. 3. The components of the keyway cutter*

The inset tool-bit, illustrated in Fig. 4, was ground to shape from a piece of $\frac{1}{4}$ in. square high-speed steel, and its length was adjusted so as to cut the keyway to the finished depth while remaining fully supported in the arm. As the tool cuts in the forward direction, the back of the cutter-bit must be given support against a flat seating, to prevent tipping when under pressure. In the working drawing, the machined seating for the tool is shown as a drilled hole, but this seating was finished to size in the following way. After the arm had been cross-drilled with a letter "F" drill, a flat was filed at the mouth of the hole on its back surface in order to form a lead for the tool-bit. This allowed the cutter to be started in the hole and afterwards forced for its full length into the arm by applying pressure in the vice.

In this way, the tool itself, acting as a broach, formed a seating with two small flat surfaces for supporting the back of the cutter.

The tool should be ground with the adequate clearances shown in the drawing, but top rake is generally best avoided, as it tends to make the tool dig into the work.

The pressure-screw should be accurately made, and provided with a flat surface at the tip, so as to give the maximum support to the tool. Some workers prefer to draw the tool through the work when cutting a keyway and, if this method is adopted, the cutting pressure will then be against the tip of the screw.

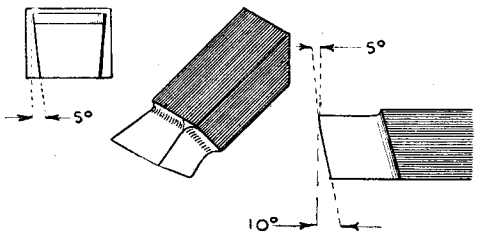



*Fig. 4. Showing the form of cutter-bit used*

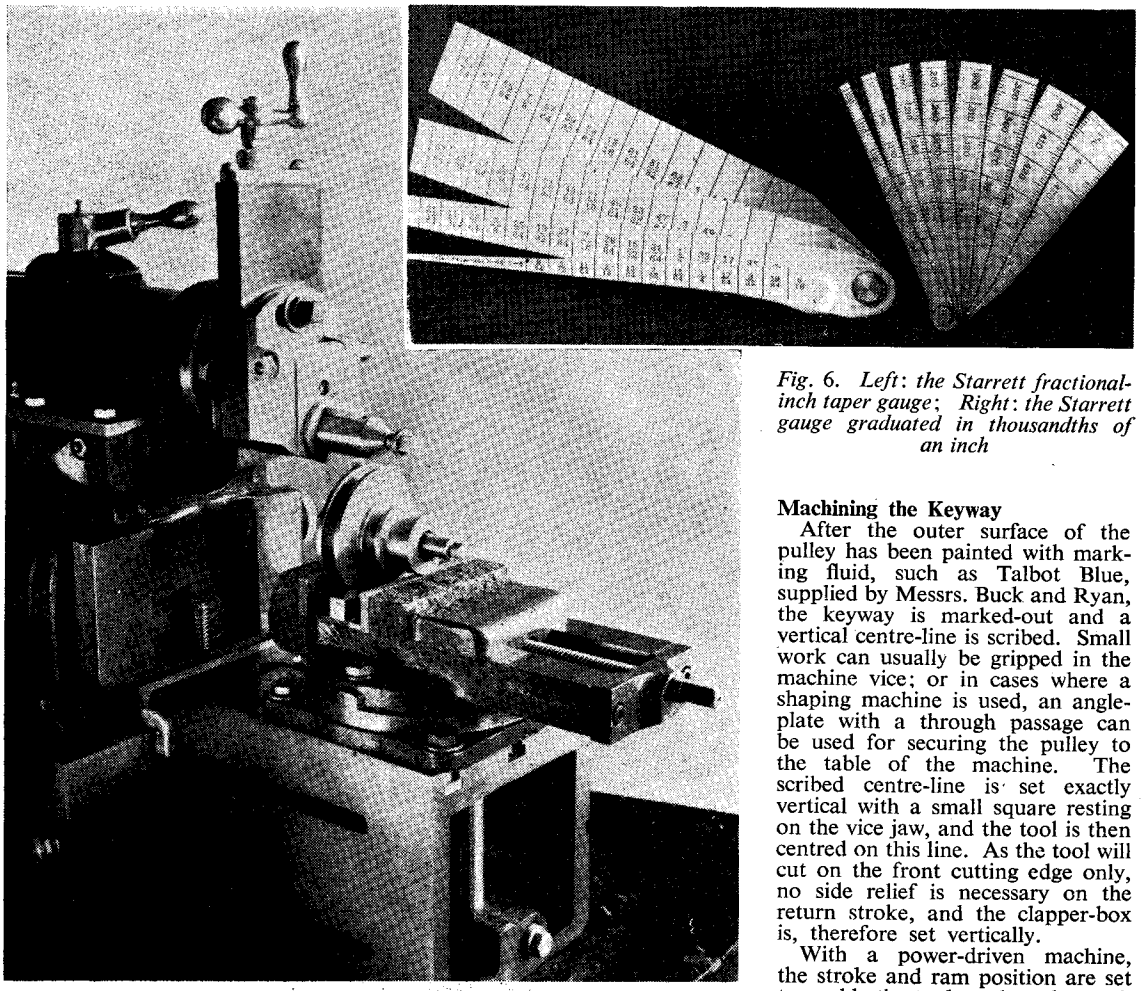


*Fig. 5. The pulley set up for machining in the shaping machine*



*Fig. 6. Left: the Starrett fractional-inch taper gauge; Right: the Starrett gauge graduated in thousandths of an inch*

**Machining the Keyway**

After the outer surface of the pulley has been painted with marking fluid, such as Talbot Blue, supplied by Messrs. Buck and Ryan, the keyway is marked-out and a vertical centre-line is scribed. Small work can usually be gripped in the machine vice; or in cases where a shaping machine is used, an angle-plate with a through passage can be used for securing the pulley to the table of the machine. The scribed centre-line is set exactly vertical with a small square resting on the vice jaw, and the tool is then centred on this line. As the tool will cut on the front cutting edge only, no side relief is necessary on the return stroke, and the clapper-box is, therefore set vertically.

With a power-driven machine, the stroke and ram position are set to enable the tool to clear the work at either end.

Although, when machining a batch of parts, it may be an advantage to make the cutter-bit the exact width of the finished keyway, it is perhaps better to work with a rather narrower tool; this will avoid chatter where the machine lacks rigidity, and will also enable keyways of various widths to be cut with a single tool.

A series of cuts is first taken to the full depth of the keyway, and the depth can readily be measured with a Starrett taper gauge of the kind illustrated on the left of Fig. 6; that is to say, the gauge is inserted in the bore and the diameter of the original bore is subtracted from the measurement obtained. Another method is to put a plug in the bore and then make a direct measurement with the gauge. After the correct depth has been reached, the reading of the micrometer index on the tool slide is noted. The width of the keyway can also be measured with a gauge of similar type; that illustrated on the right of Fig. 6 is a Starrett taper gauge graduated in thousandths of an inch. To machine the keyway to the full width, an equal amount of metal is removed on either side of the centre-line.

For this purpose, the micrometer index on the table slide is referred to, but any backlash present in the feed must, of course, be taken into account. If the table slide is locked, the amount of backlash in either direction can easily be determined on turning the feedscrew. For accurate machining, and to prevent chatter, it is important to adjust correctly the foot fitted to the overhanging end of the table; this support checks any tendency for the table to tilt downwards under the pressure of the cut, but is usually omitted in small, hand-operated machines.

With a little practice, quite accurate fitting can be done in the shaping machine and, in the present instance, the keyway was cut exactly at right-angles to the diameter of the bore, and the key itself was a light press-fit in the finished seating.

Tool-bits of the Eclipse brand are supplied heat-treated and ready for use; those of $\frac{3}{16}$ in. and $\frac{1}{4}$ in. square section are obtainable in lengths of 2 in. and $2\frac{1}{2}$ in. respectively.

As the tool-bit for the present toolholder is only some $\frac{5}{8}$ in. in length, the material will have to be cut to the finished length after the point has been ground. For this purpose, the tool is either nicked on the grinding wheel, and then broken off, or a special cut-off abrasive wheel can be employed.

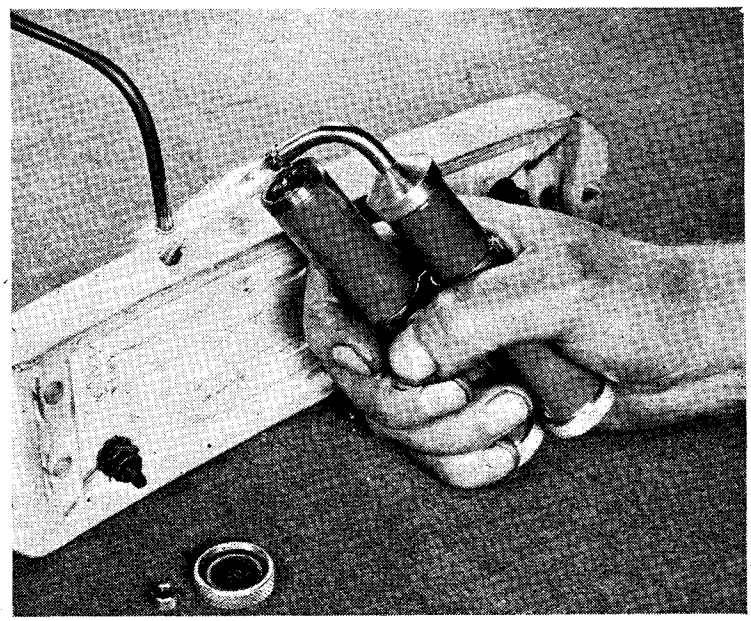
# THE VALTOCK AUTOMATIC BLOWLAMP

A NEW type of miniature blowlamp to work on methylated spirit has been introduced by Valtock Ltd., 5-6, Sherwood Street, Piccadilly Circus, London, W.1, and is obtainable from most tool dealers. It is of the self-blowing vaporising type, and its design enables a high pressure to be obtained at the jet nozzle, resulting in a concentrated high-intensity flame. No pumping is necessary to obtain the pressure, and the vaporiser is of a simple type which cannot clog or carbonise.

The blowlamp consists of two cylindrical containers, both of which can be completely sealed, so that it does not spill when carried in the pocket or tool kit; these are held parallel to each other by a spring clip which allows of lateral individual adjustment. Both cylinders contain wicks, one having a plain cap, while the other terminates at the top with a bent tube, having a fine jet at the outlet, which can also be capped when not in use. In use, the cap is removed from the first cylinder, and this is used to form a pilot heater for the jet tube, causing vapour to be generated in the second cylinder under the pressure of its own expansion. As the vapour escapes from the jet it is ignited by the pilot flame and burns with a smokeless, almost non-luminous high temperature flame.

This is an extremely useful appliance for many operations within the sphere of the home workshop, including soft-soldering and sweating, light silver-soldering, glass working, etc. It should, however, be remembered that while the actual temperature of the flame which it produces is high, it is small in volume, so that the actual quantity of heat it produces is less than that of a larger flame of lower intensity. We mention this, not as a criticism of the device, but because inexperienced operators often attempt to use small gas or spirit blowpipes for large work which is definitely outside their capacity, or without taking precautions to conserve and prevent dissipation of heat. The Valtock blowlamp will silver-solder small fittings, but cannot be expected to cope with a boiler.

The appliance is very well made and finished, the cylinders being of solid brass tube with screwed-on caps, no soldered joints being used. It weighs only $5\frac{1}{2}$ oz. and is $5\frac{1}{2}$ in. in overall height; all parts are interchangeable, and spares can be obtained if and when required.



*The Valtock blowlamp in use, silver-soldering a $\frac{1}{4}$-in. pipe nipple*

# The use of Limited Equipment

## THE FASCINATING STORY OF THE CONSTRUCTION OF THREE 2½-in. GAUGE LOCOMOTIVES

**By J. St. Hilary Webb**

OWNERS of baby lathes will find that the "4F" presents no machining problems with the exception of the curved slides for the Joy valve-gear. These entail machining a ring $5\frac{5}{16}$ in. diameter and the job will, therefore, require to be "sub-contracted." The crankshaft is easily built up. In my case, I fitted hardened steel rollers in the curved slides instead of die-blocks—contrary to statements which have been made, these definitely do revolve, and after many hours steaming, no significant wear has developed.

Boiler feed is attended to by a $\frac{3}{8}$-in. bore eccentric-driven pump, an injector, a steam donkey-pump and a $\frac{3}{8}$-in. bore tender hand-pump. The donkey pump is of $\frac{1}{4}$-in. bore and stroke with a $\frac{1}{8}$-in. bore single-acting water plunger; the valve travel is 0.06 in. and the overall height is $2\frac{1}{8}$ in. Its minimum pumping rate is about 120 strokes per minute, whilst, at the other extreme, it can be made to sound like a Browning machine gun! It is especially useful if it is desired to leave the engine unattended for a while. The injector is to "L.B.S.C.'s" design and has never given any trouble, although generally I prefer to use the donkey pump—it is more interesting to watch! The arrangement of the boiler fittings is shown in Fig. 4; for a $2\frac{1}{2}$-in. gauge engine, I am reasonably content with the layout, but the standard set by Mr. Austen-Walton certainly inspires one to do better next time. The lubricator can be seen on the running-board, and is driven from one of the valve spindles. I find in practice that this is unsound due to the marked variation between the travel when in full gear and when "notched up." The engine will run and pull with the lever two notches from centre; if the lubricator is set to operate at this travel, in full gear (six notches from centre), the oil delivery is grossly excessive.

The engine has been the subject of many experiments to find a satisfactory and economical system of firing with liquid fuel, solely because such a system is far cleaner than coal. So far, the experiments have not met with success. The first trials involved the use of an "axle-dodger" paraffin burner as described in the *Live Steam Book*. This was finally reduced to a reliable proposition when running on the bench but, among many other things, I found it necessary to fit a restrictor disc in the front flame tube to equalise the flame lengths; jet blockage was finally eliminated by inserting a ball of steel wool into the chamber behind the nipple. This burner was finally relegated to the scrap-box because it was not amenable to a wide range of adjustment and because of the difficulty of starting it under the engine. The next experiments were with various types of vapourising spirit burner. Although trouble free, these again suffered from lack of range. Finally, tests were carried out with an ordinary, multi-tube, wick burner which was soon pronounced useless due to the prohibitive running cost and because of its delayed response to adjustment of the control-valve—and so, we now run on coal! As soon as opportunity permits, further experiments will be carried out. At the moment, I have in mind a system wherein a series of jets direct paraffin on to a refractory base, spread over the firebars; if anyone has experience of such a system, I shall be very pleased to hear from him.

The third locomotive, now well advanced, is a 2-8-4 tank of original design shown in Figs. 5 and 6. It has been designed to utilise the original *Austere Ada* boiler, which is also shown in the photograph. The design has been prepared with a view to conversion to a tender engine with a large boiler should the small one prove deficient, despite my greater experience of "engine-management." One of the objects of the design is to concentrate the maximum weight upon the coupled wheels,

*Continued from page* 623, *June* 3, 1954

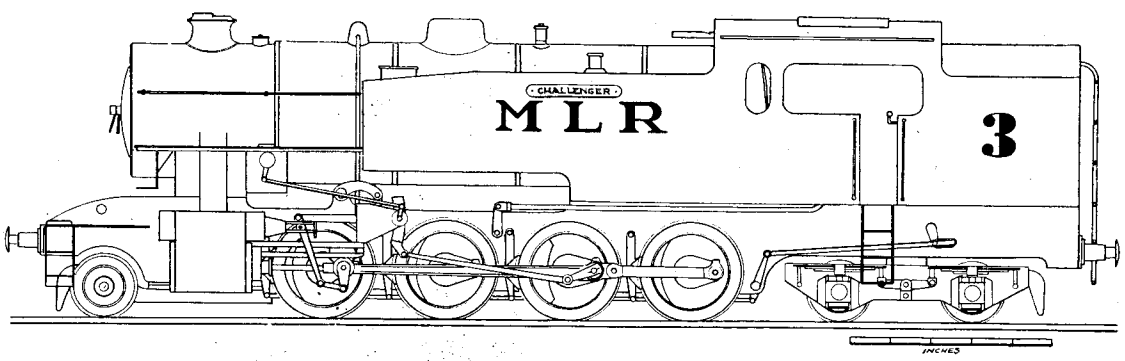



*Fig. 5. General arrangement of the 2-8-4T locomotive, "Challenger"*

hence the preference for a tank engine. A double-acting water pump is fitted and is shown in Fig. 7. This has the same delivery as a $\frac{5}{16}$-in. bore single-acting pump of the usual type but, being double-acting, the area of the delivery pipe can be halved and the load imposed upon the driving gear is substantially lessened. To ensure equal delivery on the ingoing and outgoing strokes, it is, of course, a requirement that the cross-sectional area of the piston be twice the area of the piston-rod and in this instance, diameters of $\frac{5}{16}$ in. and 7/32 in. give reasonably correct results.

Apart from the wheels, no castings are being used, the cylinders, for example, being built up from bronze tube and brass plate; $\frac{7}{16}$-in. piston-valves are fitted. Every single piece has been drawn (about forty sheets in all) to avoid the prevalent practice of measuring from the actual job. In my opinion, this can never give good results, particularly when some vital component, such as a valve-gear eccentric-rod is concerned.

The type of hornblock used may be of interest to those with limited machining facilities who are also not keen to file castings. The actual horn consists of a 1 in. length of

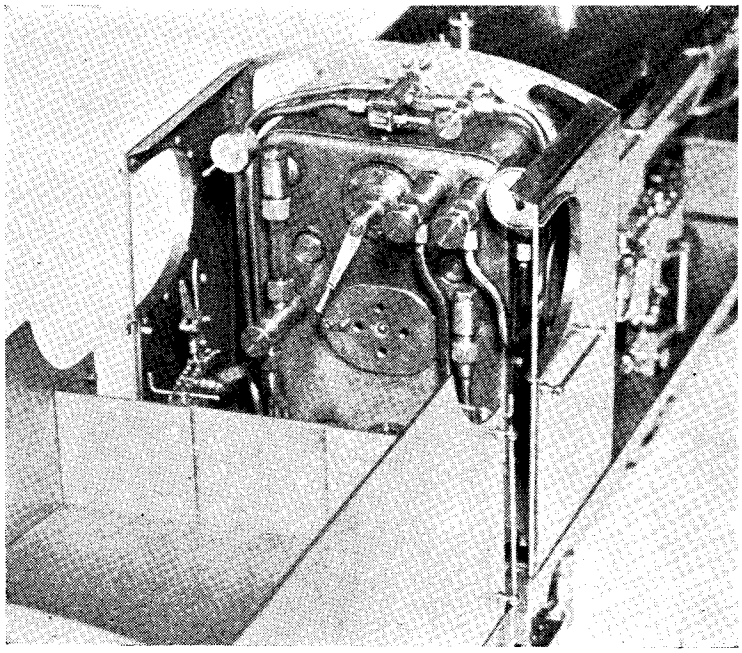


*Fig. 4. Backhead fittings on the* 0-6-0 *engine*

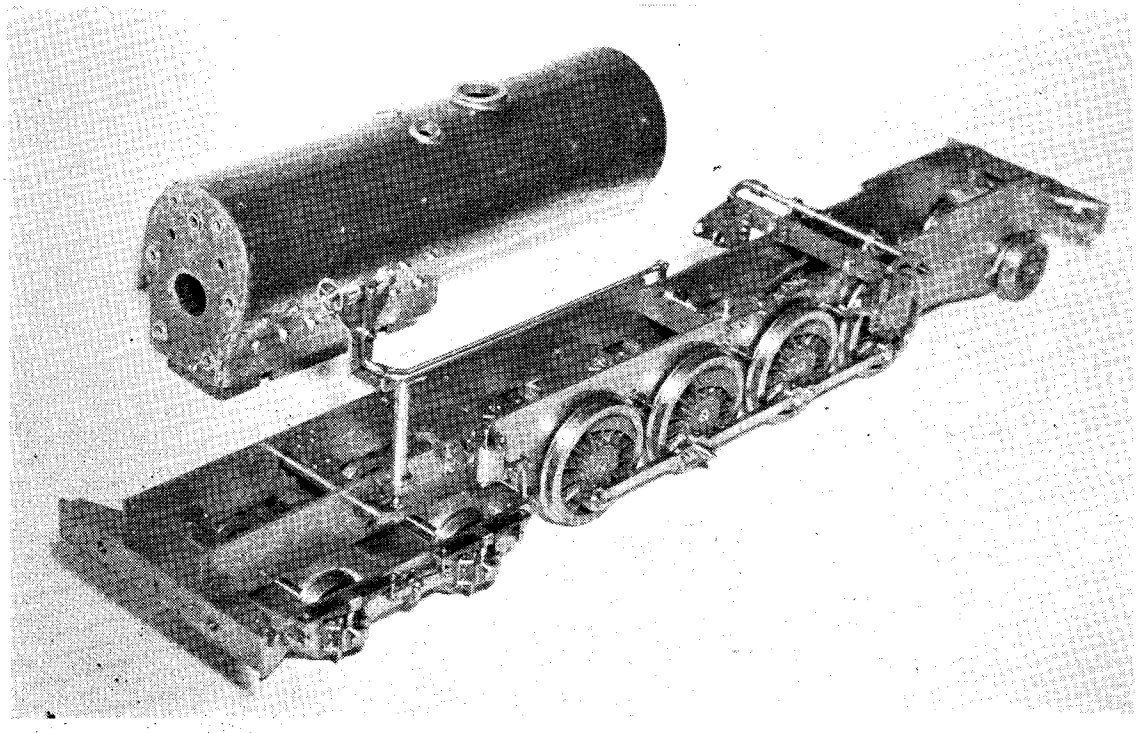


*Fig. 6. The* 2-8-4T *" Challenger " under construction*

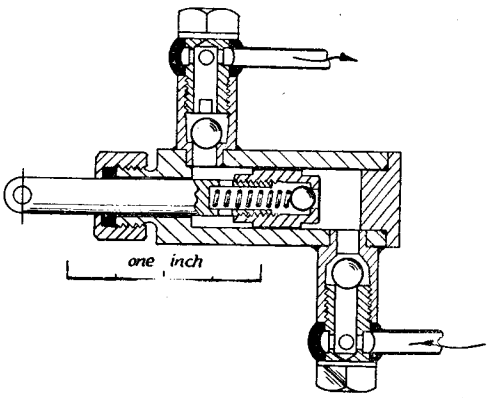



*Fig. 7. Double-acting water pump for "Challenger"*

$\frac{3}{8}$-in. brass angle, strengthened with ribs silver-soldered in position; the bearing surface for the axlebox is a $\frac{1}{16}$ in. thick steel plate, riveted to the horn. Provided that the brass angle is square, horns built in this way are bound to be accurate. It has been stated that this type of horn does not brace the frames as does the usual horseshoe pattern. Whilst there is a limited degree of truth in this statement, it should be borne in mind that in the case of this latter type, the governing factor is, of course, the strength of the rivets attaching them to the frame, and not the strength of the horn *per se*.

Finally, by way of a conclusion to this article, a few words about the driving-wheel jig to which reference has already been made. The jig is shown in Fig. 8 and, although the drawing is not fully detailed, I think that an adequate degree of information is imparted. My own jig was made in a few hours and resulted in all cranks being located at precisely the same angle and all wheels being free from wobble, which is not an easy condition to attain when using the vice as a press. Although not shown on the drawing, it is, of course, essential that the jig be mounted upon a solid baseplate, attachment being effected by bolts passing through the angle riveted to the endplates. In my case, I used an old flat iron. It will also be appreciated that the spacing of components *A* and *B*, and *C* and *D* is governed by the stroke of the cylinders, or the throw of the crankpins and the jig used for drilling the actual crankpin holes in the wheels can be utilised when drilling the plates. Notice also that to use the jig necessitates drilling the axles truly axially to receive the pilot pins of items *B* and *F*. Details *A*, *B* and *C* should be press fits within the end plates.

To use the jig, take one of the wheels from the left-hand side of the engine and locate it upon detail *A* in the left-hand end plate. Locate the axle upon the pilot of detail *B* and then insert detail *F* through detail *D*. Take a carpenter's "G" cramp (I used a 6-in. Woden) and, locating its anvils upon the faces of details *B* and *F*, screw up to force the axle into the wheel. Repeat the operation on the remaining wheels.

The next operation is to fit the right-hand wheel to each axle at ninety degrees to the other wheel, or at whatever angle the design of the engine requires. To do this, replace a left-hand wheel, with axle assembled, in the jig and fit the appropriate axleboxes and eccentrics. Take the appropriate right-hand wheel, locate it lightly upon

(*Continued on page* 678)

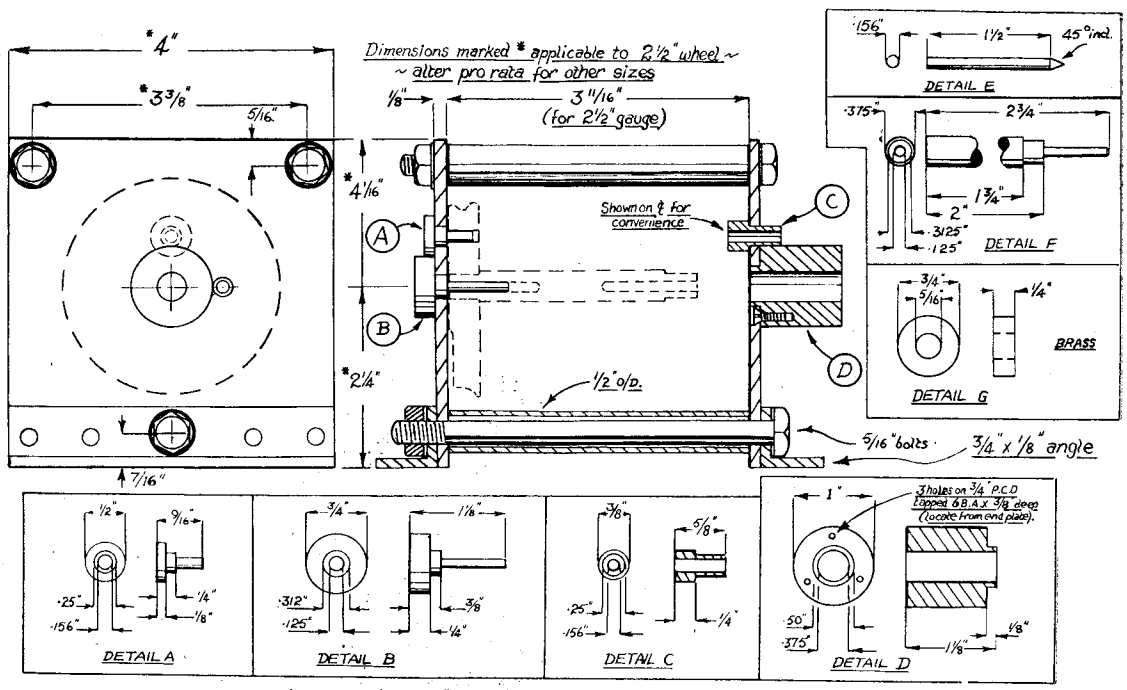



*Fig. 8. Jig for pressing coupled wheels on axles*

# Lathe Chatter .... and all that

## By "Scotia"

WHAT is the cause of lathe chatter? Usually the root of the trouble is loose or worn bearings in the spindle of the lathe, resulting in one or other end of the spindle "lifting," when tool pressure is applied to the work. Should this occur whilst turning on the orthodox way from the saddle, there is little one can do in the way of effecting some kind of cure, except perhaps of a very temporary nature.

Assuming that tightening up of the journal nuts has no effect other than the probability of the spindle seizing, the journals may be flooded with oil, which may afford temporary respite; and if one is quick to take advantage of the good behaviour of the lathe, it may then be possible to finish off the work in hand, or at least to surmount the critical part of it.

Sharp, keenly pointed tools, presenting as small an area as possible to the work, should be used under conditions like this, and in relation to the type of material and the size of the work involved, a weather eye kept on suitable speeds and feeds, the latter often becoming second nature to one accustomed to lathework.

Although as stated, a copious supply of oil will sometimes help to damp out vibration, and may be particularly effective in the older type of lathe with plain bearings, the measure is of necessity of brief duration, and the obvious remedy is to have a proper repair carried out on the spindle bearings. However, it is not the purpose of this article to go into the intricacies of scraping the plummer-blocks and re-bedding the lathe shaft.

### Problems of Hand-turning

Although perhaps not so widely practised, hand-turning work in the lathe can have its own problems in the way of vibration and chatter, too. An incorrect approach to the work while hand-turning can quite easily engender or encourage any chatter which may be, in a manner of speaking, lying dormant. This may be confined solely to the work tself, and may be due partly to its particular shape or structure, and have nothing to do with faulty spindle bearings.

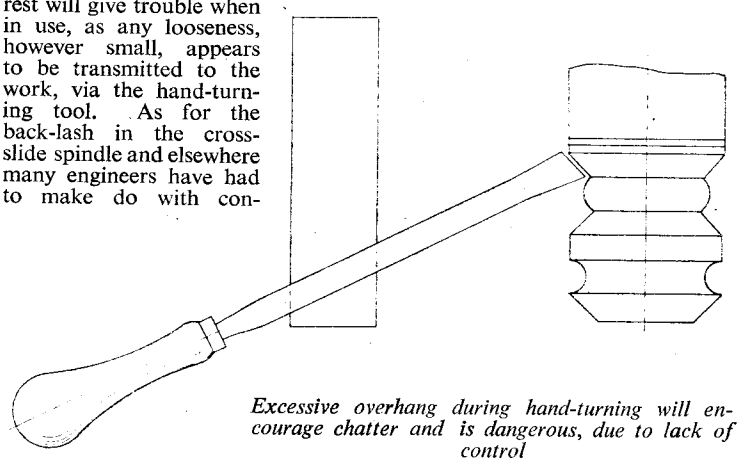
On the other hand, a loose headstock may affect the work from the initial stages of its inception to its final completion. Another factor which may contribute towards difficulty in turning smoothly, either by hand or set tool, is the presence of back-lash in the saddle. The cross-slide spindle or nut, or both, being worn, results in a movement of the saddle, which during the extent of its motion, remains out of control of the operator. This state of affairs, quite apart from any irregularity set up during turning, has been known to wreck many a good piece of work, not to mention tool breakage, which may be quite considerable over a period of time.

Should it be possible to further adjust the position of the tapered or parallel gibs, this will not cure the back-lash present, but merely serve to tighten up the normal movement of the spindle. It follows, therefore, that some kind of major repair, involving the making of a new cross-slide spindle or nut is called for in order to put the trouble right.

However, it is comforting to reflect that all discrepanices in the make-up of a lathe do not call for major repair, as even as trivial a thing as an insecurely fitted hand-rest will give trouble when in use, as any looseness, however small, appears to be transmitted to the work, via the hand-turning tool. As for the back-lash in the cross-slide spindle and elsewhere many engineers have had to make do with conditions like this for years, during which time they are often called upon to produce work of a most exacting character. Indeed, it is amazing, now and then, to see how some individuals can acquire a degree of skill which would seem at first to be impossible.

One day, a drilling machine operator was finishing off a series of counter-sunk holes. As there was spindle looseness present, not completly taken up with the thrust, he was experiencing some difficulty in finishing the work to his satisfaction, a series of hexagonal flats being prone to appear on the countersinks. As the operator began to get the feel of the work, it was evident he was master of the situation. Due to the skilful manipulation of the work in hand, the result was a perfect job.

And now, I should like to finish off these notes with mention of another machine, and although this has nothing to do with model engineering, it is of interest to those who would study the phenomena of irregularities set up during machining processes. This concerned a huge vertical facing machine with a 15 ft. dia. turn-table. A cylinder 9 ft. in height and almost 13½ ft. in dia. was clamped to the turn-table and revolving at about 2 to 4 revs. a minute. The top surface of the work was being faced and chatter was in evidence at regular intervals with tendency to increase. However, the operator was able to nullify this to a great extent. Standing by the main switch, he cut the motor and restarted in a series of quick irregular movements. This resulted in breaking up the rhythm of the circular motion throughout each revolution and had the effect of producing much improvement in the surface finish of the work.



*Excessive overhang during hand-turning will encourage chatter and is dangerous, due to lack of control*

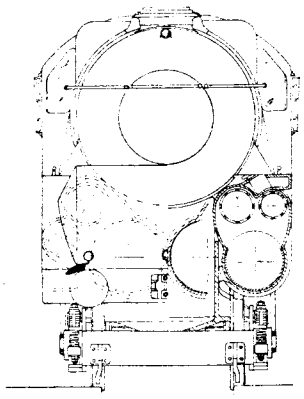
# L.B.S.C.'s Lobby Chat

## IT *COULD* BE DONE!

REGULAR followers of these notes may recall that in the "tales of the future" which I wrote for their amusement, I gave short descriptions of several locomotives, the like of which had never been built. There was a reincarnated *Jeanie Deans*, a 4-6-4 of the revived London and North Western Railway; she was a four-cylinder "simple-compound" embodying the best features of Churchward and Chapelon, with a bit of Curly added for makeweight. Then we had an ultra-modern Caledonian *Cardean*, a 4-8-2 with four cylinders, 135 deg. crank setting, which had an arrangement whereby the inside cylinders, the valves of which were actuated by the final design of Holcroft valve-gear, could be cut out when the speed exceeded 90 m.p.h., thus economising steam. The Caledonian is a Scottish line, ye ken. Arrangements were made for admitting enough steam to keep the pistons "floating," and also for adequate lubrication. The two outside cylinders, 22 in. bore and 28 in. stroke, plus a boiler pressure of 250 lb. well superheated, could easily keep a 600-ton roller-bearing train bowling along at a three-figure speed, once it was attained.

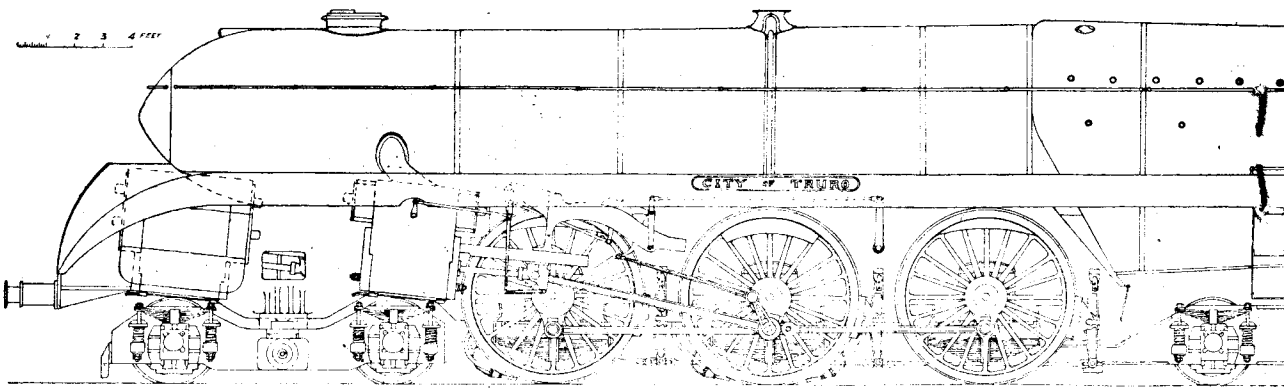
Then came *Lady Vera*. She was a Southern Railway 4-6-2 with three cylinders 23 in. × 28 in. and a "thunder-and-lighting" valve-gear that gave practically full port-opening as the crank passed dead centre; this, combined with a variable exhaust, enabled her to attain a speed of 150 m.p.h. with the "Golden Arrow." This is where Curly indulges in a belated but none the less enjoyable chuckle; because certain good folk who are directors of the famous firm of Messrs. Wiseman & Co. Unltd. solemnly averred that no train would ever stay safely on the road at such a speed. Well, since the tale appeared, a Milly-Amp locomotive has actually run at that speed with a train, and quite safely, in the land where some of the male population are reputed to wear pants that are Toulon and Toulouse; and if Milly can do it, so can Old King Coal. Incidentally, if any kiddies ever asked me why enginemen sometimes refer to coal as "black diamonds," I should tell them to get a copy of the Coal Board's current price list.

Next on the list was *Queen Mabel*. She was an enlarged version of *Lady Vera*, a four cylinder 4-6-4 with 20 in. × 28 in. cylinders, 135 deg. crank setting, cam-operated piston-valves with separate heads, giving all the advantages of poppet-valves without the concussion, and separate exhaust with variable adjustment. I happen to know that the log of the run of *Queen Mabel* from Birmingham to Euston, in charge of Driver Joy Donalot and Fireman Alice Meylen, with a twelve-Pullman load, which I set out in my last story, caused some serious thinking, as well as amusement, among certain railway "heads." All the above engines had mechanical stokers, which enabled a feminine "fireman" to "keep them hot" with ease. They also had ball- and roller-bearings throughout, including inside big-ends; so that a whiff of violets, or any other perfume, detected on an engine with a lady crew, would certainly not come from under the boiler.



*How cylinders and boiler clear the loading gauge*

The Great Western *Rose of Eythorne* was, in effect, a "King" extended into a 4-6-4 with a huge boiler, big cylinders, and a special arrangement of valve-gear, which gave the valve events needed for sustained high speed and tractive effort, plus economical working; and this brings us to the subject




*A "dream" that Swindon Work*

of the locomotive shown in the accompanying drawings.

Now, most folk, when writing of the future, draw on their imagination, and don't care a brass button as to whether the things they describe, or the happenings and incidents, are really feasible. Sometimes they are, and sometimes not. When I was a small child, I loved to read tales about the future; and Jules Verne's stories about submarines, and another one about going around the world in eighty days, intrigued me no end. It is long since submarines became an actual fact—well we knew it in the days of the Kaiser's war !—and eighty days to travel around the world, is nearly a subject for merriment. Sundry tales about flying machines were eventually made possible too, and if certain scientists don't watch their step a little, they will start something that they can't stop, and the world will meet the fate of which I read in a schoolday story. Anyway, I made certain that my tales of the future could actually happen, by first getting out tentative designs for the locomotives I described; and any of them could actually be built and run, if the track would stand the axle loading. Most of the American main lines would carry the engines.

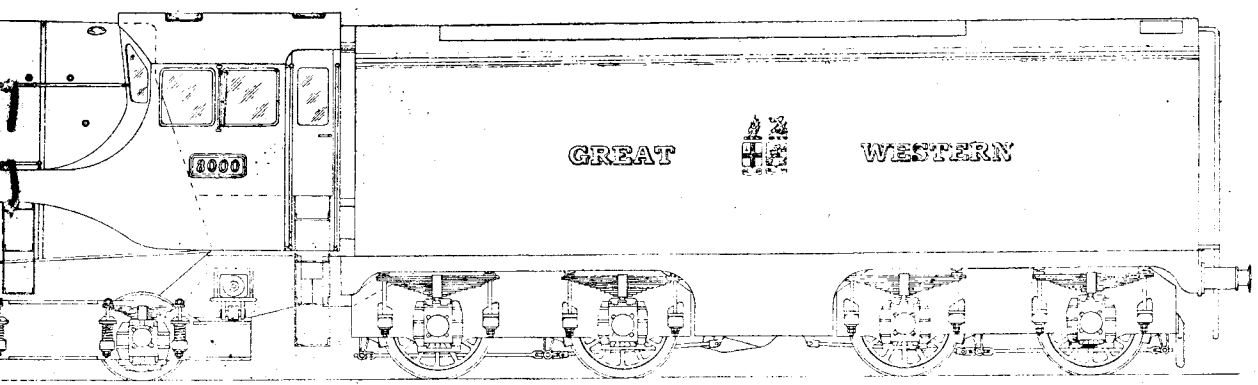
**A Nice Little Job for Swindon !**

One of the more interested followers of these notes is Mr. W. B. Hockings, a Taunton reader who is not only a very skilful draughtsman, but has had considerable experience in locomotive design and operation. In view of his location, and the fact that he has relations among the G.W.R. officials, it goes without saying that he is a redhot G.W. enthusiast. Whether he was a wee bit disappointed that the *Rose of Eythorne* didn't lick *Queen Mabel* in the " Baernegum "-London race, I'm not quite certain; but anyway, he went to work and got out a design for a super Great Western express locomotive that would make anything hitherto turned out from the Wiltshire locomotive factory, look very small potatoes indeed, and here she is. He gave her the name of *City of Truro*, in memory of a plucky little 4-4-0 of the same name, that managed to hit up a three-figure speed coming down Wellington bank in the early years of this century. Many doubts have been cast on the accuracy of the timing, same as with Charlie Hogan's effort on the Empire State Express over in U.S.A., but personally I don't doubt the speeds for one minute. I know what *can* be done—and if some of the doubting Thomases had correctly timed old *Lullington*, *Fairlight*, *Ventnor*, *Alfriston*, and other sisters of the same family, going down through Haywards Heath with a relief excursion (" go as fast as you like if the road's clear ") about the same period, well—they wouldn't be dubious any longer !

Friend Hockings has combined all the salient points of my " dream " locomotives into one very fine machine. She is a four-cylinder Churchward-Chapelon " simple-compound " with *Queen Mabel's* valve-gear, with slight modifications, and a similar boiler. The outside cylinders are 24 in. bore and 28 in. stroke, and the inside cylinders 30 in. bore and 28 in. stroke. All four cylinders, front part of frame, and smokebox saddle are in one single casting, as was common practice for many American steam locomotives before the diesel craze started; a locomotive " bed " consisted of the full-length frames, cylinders, and everything between the frames that could possibly be included, even to the air-brake reservoirs. In the present instance, the casting ends behind the outside cylinders, and the rest of the frames are of plate construction. Each cylinder has separate piston-valves for steam and exhaust; the outside steam-chests are 11 in. for admission, and 14 in. exhaust, and the inside, 14 in. and 17 in. respectively.

The coupled wheels are 6 ft. 3 in. diameter, at 7 ft. 6 in. centres; and to turn these fast enough for sustained high three-figure speeds, steam has to enter and leave the cylinders all-of-a-sudden-Peggy. It is enabled to do this by virtue of the piston-valve bobbins being separate, each operated by a cam, something after the style of the Lentz oscillating-cam gear, but faster, the valve giving practically a full port opening as the crank passes dead centre. The point of cut-off is variable right down practically to zero. The timing of the exhaust valves is also variable, according to the speed of the engine. With a boiler pressure of 260 lb. per sq. in., and a very high degree of superheat, the steam flow is about as rapid as it is possible to get.

The load on the coupled wheels is approximately 93 tons, and it goes without saying that Inspector Meticulous and Co. will raise the everlasting moan about the tractive effort-adhesive weight ratio, in view of the size of the cylinders, and the steam pressure. Well, it will interest them to know, that by means of an ingenious device, the starting tractive effort, with the lever in full gear, is limited to 55,000 lb. which is enough to make an 800-ton train jump off




*Yorks could translate into reality*

the mark like a Milly-Amp outfit. As soon as she gets under way, and the driver brings the lever back to 50 per cent. cut-off, full boiler pressure is admitted to the outside steam-chests, and a slightly reduced pressure in the inside steam-chests, thus sustaining the tractive effort (which rapidly drops off in a normal locomotive, and explains why a steam train doesn't accelerate like an electric) and this state of affairs continues all the time that the engine is working according to the gospel of George Churchward.

With the high tractive effort sustained all the time, it doesn't take the engine very long to get up in the nineties, the driver bringing the lever back, as in normal working, by gradual stages. As the 15 per cent. position is reached the engine automatically changes over to compound working, the intercepting valves diverting the exhaust from the outside cylinders to the inside steam-chests, which are then cut off from the main steam supply from the boiler. At the same time, the cut-off of the inside valves is automatically lengthened to 50 per cent., which remains constant for compound working. No reheating of the outside exhaust is necessary, on account of the high initial temperature of the steam. The timing of the exhaust can be varied according to the speed of the engine. This method of working is really the principle of the Caledonian engine mentioned in the opening paragraph; but it is carried a step further, because the inside cylinders are still doing a mighty good job of work, instead of the pistons, just on the float, being merely "passengers."

**A Good Steamer**

There would be no question of the ability of the boiler to furnish steam; the barrel is nearly full of superheater flues, 112 of them, $3\frac{3}{4}$ in. diameter, plus 24 ordinary tubes of $2\frac{3}{8}$ in. diameter. The heating surface of the tubes and flues totals 2,556 sq. ft., firebox and combustion chamber 360 sq. ft., thermic syphons 91 sq. ft., giving an evaporative total of 3,007 sq. ft. The type "E" superheater adds another 1,530 sq. ft. giving a grand total of 4,537 sq. ft. With a grate area of 90 sq. ft. stoker-fired with a bit of good honest Welsh coal, a fireman of either sex wouldn't have to worry. Even with the rubbish dished out by the Coal Board, a grate of the given area, plus a power shaker, and the steady eight-beat blast when running simple, would keep her on the pin. She would use very little steam when running compound, especially with roller-bearing stock. The engine herself would have ball and roller bearings throughout.

No artificial streamlining would be necessary, nor any smokelifters or "blinkers," as the shell-nosed smokebox, sleek outline, and shape of cab front, would offer little resistance to the atmosphere. The cab itself is of the vestibule type, something like those on the Canadian Pacific, erected on anti-vibration mountings; insulated, and sound-proofed as far as possible, the windows being double-glazed. The top of the tender would be covered in, a very necessary form of construction for sustained three-figure speeds in all weathers. It runs on two four-wheeled bogies, and carries 7,800 gallons of water, and 15 tons of coal, plus the stoker mechanism, and automatic water scoop. The weight of it would be approximately 80 tons, equally distributed over the two bogies. As to the engine, the leading bogie would carry 26 tons, the coupled wheels 93 tons (hence the need for a road with 150 lb. rails, as mentioned in my tales) and the trailing bogie 30 tons, making approximately 149 tons for the engine, or a grand total of 229 tons for the whole bag of tricks in running order, plus Rob and Brian, or Joy and Alice, as makeweights! The height from rail level to top of chimney is 13 ft. 4 in. and the width over outside cylinders approximately 8 ft. 6 in. so she would be able to run over most British main lines, if the rails would carry her. There would be no question of too high a centre of gravity, as the height of the boiler centre-line above rails, viz. 9 ft. 6 in. is not excessive, even ignoring the weight of the Bill-Massive-style "works." In the heyday of steam in U.S.A. and Canada, locomotives were running, which were much bigger and heavier, as can be confirmed by reference to older editions of the *Locomotive Cyclopedia*.

**Now—Swindon**

Well, there is some idea of what *could* be done, and I'd bet a million dollars to a pinch of snuff that the boys at Swindon Works would be tickled to death to build her, and add a few special blobs and gadgets of their own. They might not like the idea of fitting the quick-acting Westinghouse air brake, but the standard vacuum brake would be next door to useless at the speeds she would knock up; and Rob—or Joy—wouldn't want to have to shut off at Reading and start applying brakes to make certain of pulling up safely at Paddington.

Did I hear somebody saying, what about describing how to build her in $3\frac{1}{2}$-in. gauge? That *could* be done, too; but let's finish what we are doing, before thinking about any more.

# THE USE OF LIMITED EQUIPMENT

(*Continued from page* 674)

the end of the axle and insert detail *E* into *C* and through the crankpin hole in the wheel to correct the alignment. Insert *F* through *D*, with the brass thrust-pad *G* interposed between the wheel and the shoulder on *F* and press the wheel home, using the cramp. It is, of course, essential that detail *G* is truly parallel and that the machining of the various components be carefully carried out.

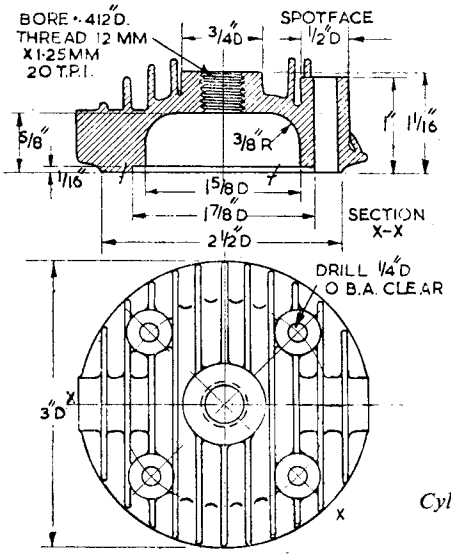
In my case, I had all eight wheels fitted in about ten minutes, with no headaches and the coupling-rods, which are fitted with close-fitting bushes, passed over the crankpins in the manner of a gauge.

And so, this account of my adventures must close. The workshop facilities have recently been improved by the introduction of a 2-in. Wade B.G., S.C. lathe, obtained in part exchange for the hard-worked "Super Adept," still as good as new apart from a somewhat worn front headstock bearing. Throughout the four years that I owned and abused it, its maintenance cost but 7s. 6d., for a new mandrel. In fact, I often think that it was a far better tool than its successor; certainly, it was more accurate. The workshop, which, incidentally is now more pretentious, because I reside in a house once more, also boasts a drilling machine, purchased from Gamages for sixty shillings, and a grindstone which, very belatedly I constructed myself. To anyone living in the vicinity of Warwick who would care to see the various models that I have described, I extend a most cordial welcome; the editor will, I am sure, be pleased to readdress any letters sent in to me.

# The 50 c.c. "BUMBLE BEE"

## A NEW DEVELOPMENT OF THE "BUSY BEE" AUXILIARY ENGINE INTENDED PRIMARILY FOR STATIONARY WORK

By Edgar T. Westbury




*Cylinder-head* (1 *off, aluminium alloy die casting*)

THE bolting lugs of the main bearing housings may now be drilled, after which each of these components in turn may be assembled temporarily on the crankcase for spotting the tapping holes in the sides of the latter. It may be observed that there is some latitude in the size and pitch of threads which can be used for the bolts, studs and nuts on this engine; in this particular case, the studs may be either 0 B.A. as specified, or ¼-in. B.S.F., which is over 0.020 in. larger, as there is plenty of metal to allow of this. Those who favour metric sizes (incidentally, having had to work in these measurements, I do not share their whole-hearted enthusiasm—but that is another story) may use 6 mm. studs. Whitworth threads are excellent for the "rooted" end of the stud, as it affords maximum strength of the thread itself in the relatively soft aluminium alloy; but the core strength of the stud is reduced, and the thread is clumsy, with less security, on the other end.

Care should be taken to ensure that the angular location of the housings is arranged to bring the feet into alignment; this is very easily accomplished by setting the assembly on a surface plate or other flat surface, and bedding the feet firmly down, before spotting the tapping holes in the crankcase. At the same time, a check should be made on the top surface of the crankcase; if this has already been machined, a straight-edge should be laid across it and the distance from the extreme ends to the surface plate measured to ensure that it is parallel. Otherwise, a general check on the rough top surface, and its relation to other external surfaces, is sufficient, as the method to be described ensures parallel alignment of the surface to a high degree of accuracy.

I have already briefly referred to this method, which consists of bolting the crankcase assembly together and mounting it, by its feet, on the faceplate. If the feet have been machined as described, to ensure that they are at exactly the same distance from the bearing centre in each case, parallel accuracy of the top of the crankcase top is thereby ensured; but as a super-check, a mandrel may be pushed right through the main bearings, so as to project at each end, and the distance from the mandrel to the faceplate measured. It will be clear that this is a more positive check than can be obtained when machining the crankcase top on an angleplate in the usual way; and it is no more difficult to carry out, as the feet can be clamped to the surface plate just as easily as an angle plate, and the set-up is fairly well balanced except for the offset of the cylinder seating.

In order to ensure correct location of the cylinder, it is advisable to fit a "bung" or cross-piece of hardwood to the cored hole to enable the centre to be marked out. I have encountered one or two cases, in the machining of "Busy Bee" castings, where errors in the location of the cylinder have caused trouble—in one case the operator bored right through the crankcase wall on the exhaust side, and then complained that the casting was wrong! Setting up from a rough cored hole is always a fallacy, because one is always at the mercy of the skill or care of the moulder in placing the cores in the mould.

As previously mentioned, the seating should be bored a snug fit for the cylinder skirt, and deep enough to clear its length, the remainder of the hole being bored slightly larger than the cylinder bore to avoid risk of rubbing or fouling of the piston skirt at B.D.C.

**Locating Cylinder Studs**

In drilling the holes in the cylinder base, and the corresponding tapping holes in the top of the crankcase, it is impossible to use the "spotting through" method, and marking out of the individual surfaces, unless very carefully carried out, is liable to involve errors, with a risk that the studs will not line up properly with the holes on assembly. I have found it an advantage in such cases to make a template about ⅛ in. thick in any convenient metal, boring it out to fit over the cylinder skirt and drilling tapping size holes in the appropriate positions. Mark

the two sides of the template, also exhaust and transfer edges, to avoid risk of inversion or placing back to front. Clamp it to the cylinder base and spot the holes through it, then turn it upside down and locate it on the crankcase by means of a spigoted plug, drilled centrally to take a bolt, which in conjunction with a bar across the inside of the crankcase, will secure the template in place for spotting the tapping holes.

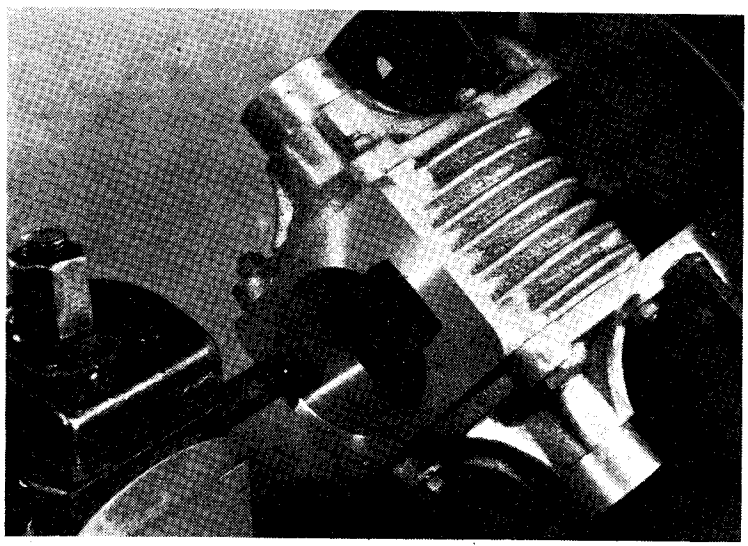
The same choice of sizes of studs as for the bearing housings is permissible, but in either case substandard nuts will be necessary to secure the cylinder, as the base flange, and the radius of the holes from the cylinder centre, are restricted in dimensions. I have often been severely "told off" over this particular detail, but it is quite deliberate, and it is by no means without precedent in motor cycle or aircraft engine practice, where the studs are always kept as close to the cylinder barrel as possible to ensure maximum strength against shear stress in the flange. I once had a motor cycle (no names—no pack drill !) with widely-spaced cylinder studs which gave excellent accessibility—but it let me down twice with a fractured cylinder base. After that I bought a Rudge, which at the time was noted for the use of undersize nuts and close spacing of studs.

It is by no means a difficult or tedious job to make four undersize nuts to fit whatever studs are employed; while you are about it, they may well be made anything up to double the normal depth to ensure maximum strength of thread. I found some "surplus" 0-B.A. steel nuts having an external size to fit a 2-B.A. spanner, which have proved extremely useful on this and many other jobs, but I regret that I cannot refer readers to a regular stock supply of this particular item; a search round the local surplus markets, however, might prove profitable.

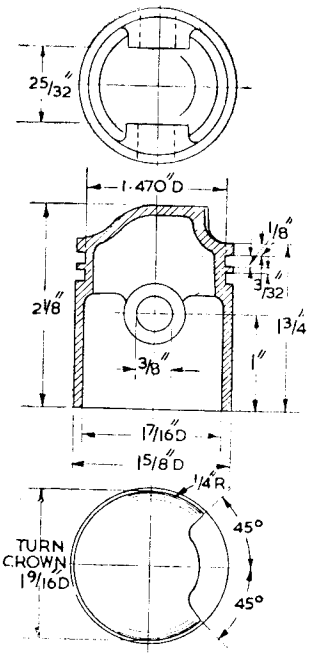
The upper surface of the holes in the cylinder flange should be spotfaced, using a short "inverted" cutter with a tapped hole to screw on a shank turned to fit the clearance hole, and inserted from the other side. If the shank is screwed right-hand thread, the teeth of the cutter must be left-handed; its outside diameter must be slightly larger than the size over the *corners* of the nuts.

**Cylinder-head**

The die casting for this, as already mentioned, is identical with that of the "Busy Bee" engine, and can be machined in the same way, most surfaces being accessible by holding it in the chuck by the extension of the central boss. Before setting up in this way, however, this stalk should be trued up by chucking the casting in the reverse position, gripping it over the outside of the bottom fin; in this way, the surface of the stalk can be held much more firmly and truly in the chuck without risk of straining the jaws.



*Crankcase assembly set up on faceplate for facing and boring cylinder seating*




*Piston* (1 *off, aluminium alloy die casting*)

The joint face, recess, and inside of the combustion chamber can be machined at the same setting; make the recess a good fit over the spigot of the cylinder, and its depth slightly less than the latter, so that when bolted down, it bears hard on the spigot face rather than on the broad outer face. If the head is lapped in to the spigot, no difficulty should be encountered in maintaining a perfect metal-to-metal joint, but the use of a gasket ring is permissible if a suitable size is available, and the spigot and recess must, therefore, be modified to suit.

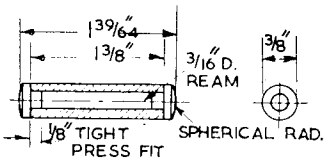
After cutting off the stalk, the head is again chucked in the reverse position for facing, drilling and tapping the sparking plug boss. It will be seen that a 12 mm. × 1.25 mm. thread is specified, as it has been found that a 12 mm. plug gives excellent all-round results, but other sizes may possibly be more readily available in individual cases, and all sizes from 10 mm. to 14 mm. have been successfully used. It may be found necessary to recess back the face of the boss to suit the reach of the plug employed, but from my own experience I do not consider it desirable that the end of the plug-body should come exactly flush with the inside of the combustion chamber; it is better for it to be

slightly "pocketed," that is, to reach less deeply into the head, but it is important that any unwanted threads should be cleared away, and slight bevelling or flaring of the mouth of the hole is an advantage.

As the decompressor is not normally required on a stationary engine, the horizontal bosses in the casting may be left solid, or alternatively they could be used to take a priming or compression tap if desired. Such taps were at one time standard fittings on most engines, and there is something to be said for providing a means of introducing "a drop o' special" into a reluctant engine on a cold morning; but this needs to be done with discretion, and I suspect that one reason why taps became obsolete was that they encouraged the less intelligent user to kill his engine by kindness.

If any departure from standard compression ratio is made, the machining of the cylinder-head, or the top face of cylinder, may be suitably modified. The engine was originally designed to cope with the low-octane fuels, and will even run on lower distillates than petrol, though this is not advised because of their effects on lubrication. Much higher compression ratios are possible with fuels now available, though whether they can be employed to best advantage is another matter; there is obviously scope for experiment in this and other details of the engine design, but don't be too ready to jump to conclusions over these matters, as there is more in them than meets the eye.

Either studs or set-screws can be used to secure the head; the former are best from the aspect of good engineering practice, but set-screws enable the cylinder-head joint to be lapped more easily any time it is removed for overhaul or inspection.

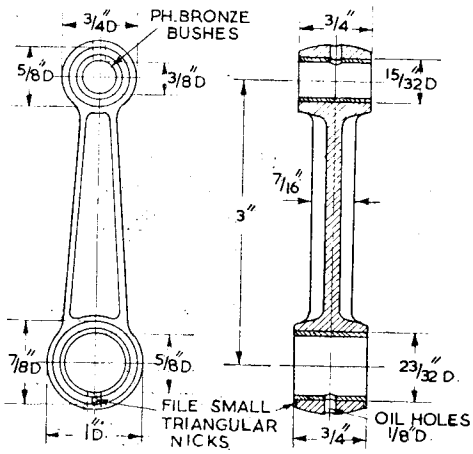



*Gudgeon-pin*, (1 *off*, *M.S.*, *case-hardened, with soft end pods*)

**Piston**

This also is identical with the die casting used for the "Busy Bee" and the same method of machining is recommended, including the finishing of the external surface by mounting on a spigot jig, with a cross pin and eyebolt to secure it in position. I have described this method in connection with other engines besides the "Busy Bee," and it is the only method I have found entirely satisfactory to ensure that no distortion of the thin wall of the piston can occur in the finishing operation. Piston clearance should not be less than 0.004 in. at the skirt, increasing to nearly twice this amount at the top land. Larger clearances may reduce risk of tightening during the running-in period, but are more likely to cause loss of efficiency at a later stage.

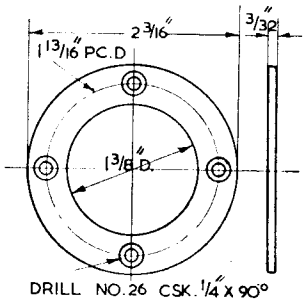
The deflector of the piston should on no account touch the cylinder anywhere, and thus the sides should be turned at least 1/32 in. undersize, starting from the level of the exhaust and transfer cut-off faces; it should also be well rounded off on the top corner to correspond more or less with the inside contour of the head, and all sharp corners and rough surfaces trimmed. Polishing the piston crown will help to prevent, or at least delay, adhesion of carbon, but has very little further effect on efficiency in a moderate-duty engine of this type.




*Connecting rod*, (1 *off*, *aluminium alloy die casting*)

**Connecting-rod**

This is also a die-casting of ample section to withstand mechanical stresses, and is machined in the manner recommended for the previous engine, the essential thing being to ensure that the eyes are bored exactly parallel with each other. Of the various ways of dealing with this operation, I find that one of the most satisfactory is to clamp the web of the rod to a flat plate with the bosses overhanging at each side. The plate can then be moved about on the faceplate to bring each eye in turn into the central position for boring and facing the accessible side; a pin mandrel can then be used in each case for the reverse facing operation.




*Ball-race retainers* (2 *off*, *Duralumin, brass or steel*)

The fitting of bushes to the eyes may be regarded as optional, as the aluminium alloy has fairly good wearing properties, and when wear takes place it is practically as easy to renew the rod as to fit new bushes. Bronze certainly wears longer if properly fitted in the first place, but there is some element of risk in the fitting of bushes in these particular circumstances. They should be given a greater amount of interference than usual, as their thin wall enables them to contract under stress, but if too tight they may burst the eyes of the rod. I recommend about 2-thou. interference for the little-end and 2½-thou. for the big-end. Great care should be taken to keep the bushes axially true when pressing them in.

Should the bushes turn in the eyes, due either to imperfect fitting or partial seizure of the bearings, they will effectively seal off the oil inlet hole, but I have yet to find a really satisfactory method of keying them. Note that the oil holes should in each case be in the ends of the eyes, to admit the oil mist at the point of lowest pressure—gravity plays practically no part in assisting the oil feed, so that the idea of drilling the holes in the *top* of the bearing, wherever that may be, is a fallacy. A slot milled right through the boss, to expose a greater part of the bearing surface, is better than a round hole; and as both sides of the big-end bearing are against the crank cheeks, small nicks filed in

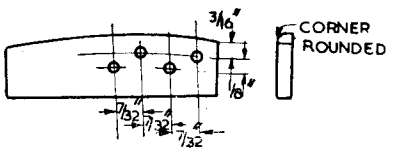
(*Continued on page* 686)

# THE ALLCHIN "M.E." TRACTION ENGINE

*to 1½ in. Scale*

By W. J. Hughes

I'M very sorry for the somewhat long time which has elapsed since the last article in this series, but when illness intervenes there's nothing one can do about it, is there? The said malady also prevented completion of sheet 7 of the drawings, but this is now ready, for the lads who are waiting.




*Jig for drilling webs of tee-rings*

**Jig for Drilling Webs of Rims**

Having last finished riveting the strakes on the tee-rings, the vertical webs of the latter require drilling for the attachment of the spoke-palms. A simple jig will help here, and it is easily made from a short length of $\frac{1}{2}$ in. by $\frac{1}{8}$ in. mild-steel —about $1\frac{5}{8}$ in. or $1\frac{3}{4}$ in. will do.

File one edge of this to a curve to fit the inside of the horizontal web, and round the inside edge to clear the radius between the two webs. Set the dividers or oddlegs first to $\frac{3}{16}$ in. and then $\frac{5}{16}$ in., and scribe the two curved lines as shown. Square the other lines across, at 7/32 in. apart, centre-pop the points very carefully and accurately, and drill the four 3/32-in. holes. Slightly countersink them on the outside, and remove the swarf on the inside.

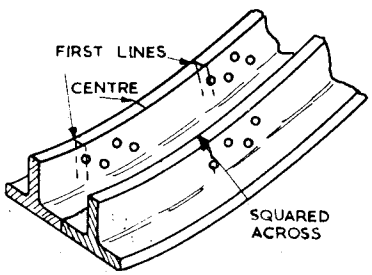
Now divide the vertical web on one side of the rim into eight equal parts; this can be done on the inside edge with dividers, and squared across the face of the web with a scriber. Check these lines with the dividers before starting to drill.

Photograph No. 64 shows how the holes are drilled. Press the jig well up into the corner, so to speak, see that the end hole is exactly central over one of the lines on the web, and use a small toolmaker's clamp to secure the jig. Drill the four holes right through, slacken the clamp, and move the jig to the next position, taking care that the same hole in it is central with the line on the web.

When all the holes are drilled on one side, square two of the lines across the inner edge, and find the centre between them with dividers. Square this across to the inner edge of the other web, as sketched, and this gives the starting point for dividing the second web into eight.

One point needs to be watched here, though; when the jig is placed in position, it will be the *other* end hole—i.e., nearest the clamp—which should be central with the line on the web. The sketch should make this clear, I think.

Having drilled the holes in the second web, treat the other wheel-rim in exactly the same way, of course. Finally, very slightly countersink all the holes on both sides.




*How to set the holes on the second web*

**Jig for Drilling-spoke Palms**

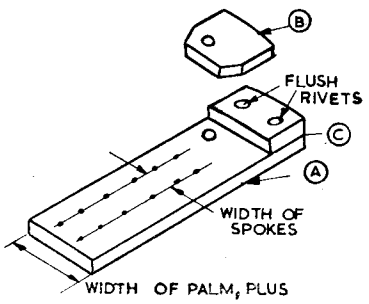
The spoke-palms now require drilling, but with *one* hole only—see article dated December 17th, 1953, for spoke drawing. Here again a simple jig will save a lot of setting out.

Take a strip of steel *A*—I used 13-gauge—a gnat's whisker wider than the spoke-palms, and at one end rivet an odd piece *C* at right-angles; here I used 10-gauge copper, because it must be thicker than the spoke is. Scribe and centre dot two parallel lines as shown, the width of the spoke apart.

Now set out the hole on *one* of the spoke-palms, centre-punch it, and drill it through 3/32 in. diameter. Drill another 3/32-in. hole through an odd scrap of steel—shape doesn't matter really—to form piece *B*.

Grip piece *A* in the machine vice so that its upper surface is just below the top of the jaws; if you now lay the spoke on it, the palm should drop between the jaws and the parallel lines will show whether it's straight or not. Press the palm close up to piece *C*, and use the hole in it to jig-drill one through *A*.

Lay piece *B* loosely on *C*, and line up the three holes in *B*, the spoke-palm, and *A* by passing a 3/32-in. rivet through them. Clamp *B* to *A* and *C* with a toolmaker's clamp, remove the rivet and the spoke, and your jig is complete.




*Jig for drilling spoke-palms*

All you need to do now is to drop a spoke between the jaws on to *A*, slide it up under *B* until it touches *C*, take care it is straight, and drill right through the hole in *B* and the palm. Remove spoke and repeat dose as necessary—but watch out that swarf doesn't accumulate under *B* and prevent the spoke-palm touching *C*!

*Continued from page 265, March 11, 1954.*

And you should make your jig, *and* drill the spokes, almost in less time than it's taken to tell you how to do it ! Again, very slightly countersink the holes in the palms on both sides; this makes sure when components are riveted together that no swarf prevents the surfaces being in close contact.

**Jig for Building Wheels**

Another jig is now necessary to ensure that the wheel-hub is concentric with the rim when building the wheels. Photograph No. 66 shows the jig, and the necessary dimensions are given on the drawing. It will be seen that a wooden disc is bored out to fit the rim, and is fitted with a steel spigot turned to fit the bore of the wheel-hub.

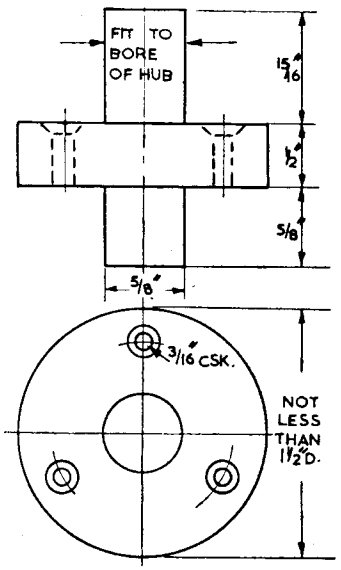
First of all, turn up the centre-post. Mine was turned from solid mild-steel bar 2-in. diameter, but it could be fabricated to save metal —in fact, J. S. Christopher did just that when making his jig. The important thing is that all the surfaces must be concentric and true, so although the post can be roughed out in the chuck, it should be finished between centres.

It is also important that the upper spigot is a good running fit in the wheel-hubs, with no shake, and the diameter of the flange should not be less than 1½ in., and preferably more, in order to provide a good firm base for the post and support for the hub-flange. The three holes for the screws should be well countersunk, on top.

You will also require for later use two "washers," one 9/16 in. thick and one 17/32 in. thick, bored to fit the upper spigot of the post. Again I turned mine from the solid 2-in. bar, but they need only be about 1¼ in. in practice. The surfaces *must* be parallel with each other, and square with the bore.

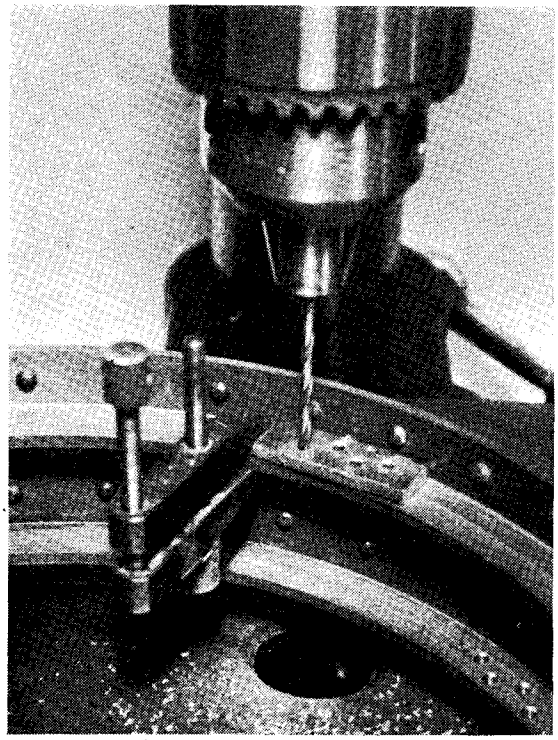
In my former air-raid shelter—now used as a junk-store—I found a piece of hard pine about ⅞ in. thick and 10 in. wide, from which could be sawn a disc 9¾ in. in diameter. This having been done, it was fastened to the faceplate with four 1¼-in. woodscrews, and faced up on one side, using a keen round-nosed tool and a fast speed.

It was then reversed on the faceplate, and the other side of the wood faced up. The reasons for facing

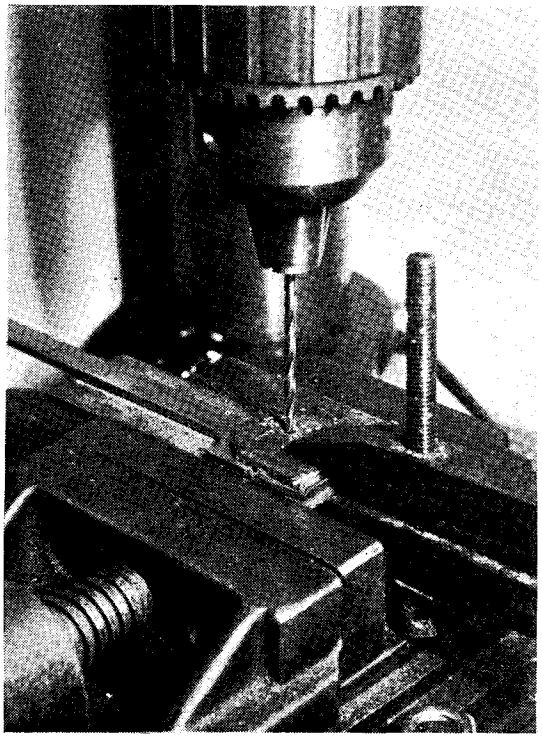



*Centre-post for wheel-jig*

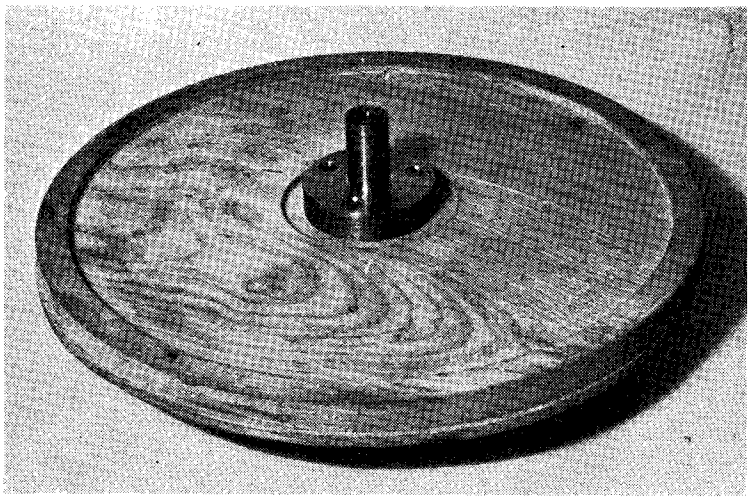
*both* sides are (*a*) to make sure that the wood fits the plate all over, and



*Photograph No. 64. Using the drilling-jig on the teering web*



*Photograph No. 65. Method of holding and using the drilling-jig for the spoke-palms*



*Photograph No. 66. Jig to aid in building hind wheel*

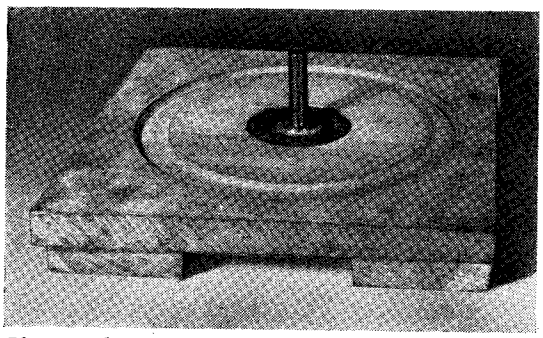
(*b*) if only the outside were faced, warping would be quite likely, due to uneven shrinkage, even with old well-seasoned wood. Timber can play some very funny tricks; I remember a friend making a large driving-wheel pattern in wood which was many years old, and, therefore, presumably, well seasoned. It was certainly nice and dry. When the castings came from the foundry, one diameter was $\frac{1}{4}$ in. less than the other on every wheel—they were oval, in other words ! The air turned blue for miles ! Yes, the pattern had shrunk.

Returning to our jig, the next thing is carefully to bore out the recess for the tee-ring to fit, which it should do well, but not tightly. (In use, the ring just drops into this recess, but the ends of the strakes rest on the outer surface of the disc). This boring can be done with a knife tool, of course.

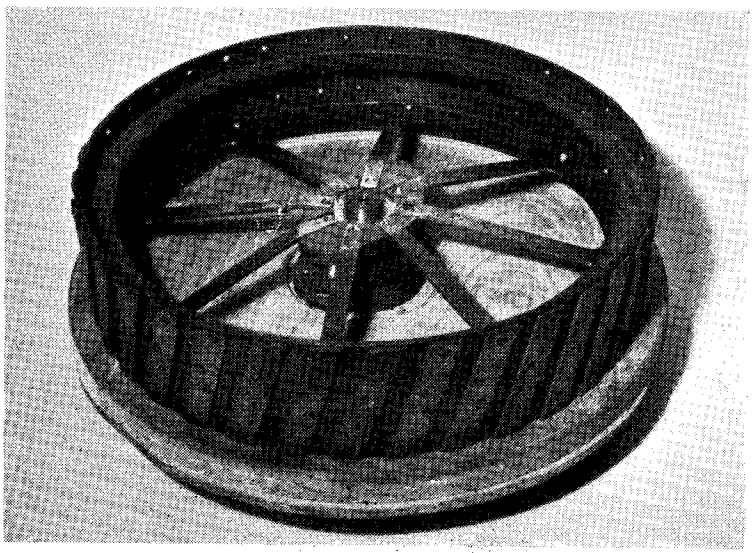
Next run a half-inch drill through the centre of the disc, and bore out the hole to be a *tight* fit on the short spigot of the centre-post. Finally turn the recess at the centre which takes the flange of the post. This should be of such a depth that when the flange of the post is screwed down, its upper surface will be 9/32 in. higher than the outer edge of the disc, as shown in the drawing.

You can then hollow out the wood near the edge, to allow the fingers to place nuts on the screws which will hold the spokes temporarily to the tee-ring, but don't weaken the jig by taking too much out.

Press the centre-post into its hole, and fasten it down with countersunk wood-screws—I used 1 in. by 6. As a test, replace on the mandrel-nose, and switch on, when the centre-post should revolve dead true,



*Photograph No. 67. Form of jig used by J. S. Christopher, with fabricated centre-post. (Photo. by J. S. Christopher)*



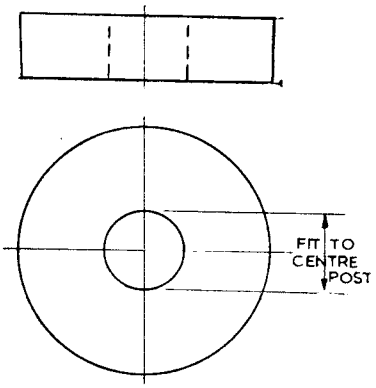
*Photograph No. 68. First stage in building wheel, with eight spokes fitted*

and concentric with the outer recess. Remove from the lathe, but leave the disc screwed to the faceplate, which will help to prevent any warping or shrinkage in the wood.

**Doubts of Accuracy**

By the way, one or two people have seen a similar jig to this described in my book, and have written to cast doubts on the accuracy of the method; they think the finished wheels may have a wobble. Well, now, I may have been lucky, or I may have been extra careful, but my wheels run practically dead true. And since these wheels only revolve slowly, I think it would take more wobble than mine have to be noticeable when the engine is working.

Of course, if you have access to a lathe which will take the wheel complete, you could leave the bore of the hub undersize, build the wheels in the jig, then clip them to the faceplate one at a time and bore the




*Spacing-washers for wheel-jig (one 9/16 in. thick, one 17/32 in. thick)*

hubs to size. Then you'd *know* they'd run true; this is what both J. S. Christopher and Trevor Whitaker have done.

However, most builders haven't access to such a lathe, so will have to trust to their skill in fitting. But don't worry; if you follow the instructions and take care you'll not go far wrong !

**Building the Wheels**

Let's take the right-hand wheel first; doesn't matter which we start with really, but we've got to start somewhere. Place one of the rims in the jig, and the right-hand hub-centre, with its larger flange *downwards* (important, that !) on the centre-post. Remember the two hubs are different, so make sure you've got the correct one !

You will recall that when milling the spokes, we left the width a few thou. oversize, to allow for individual fitting, so before each spoke is bent, it will need the edges trimming with a file until it will fit into its milled slot in the hub-centre.

I found it best to bend each spoke individually; I did cut a cardboard template to the angle for the palms, but of course the angle varies slightly in each case because of the oval shape of the hub. Don't forget that the bends on the spokes should be as *sharp* as possible; I saw a free-lance engine recently in which the spokes were almost S-shaped, with not a straight bit anywhere.

My method of bending a spoke was to grip it in the vice, palm uppermost, as sketched, the rivet-hole being to right of centre. Setting a large tool-maker's clamp to be a sliding fit on the palm—a large movable spanner would do, of course —this was slipped over the palm vertically, and pulled towards me.

The spoke then being removed from the vice, a 3/32-in. rivet was put through the hole, and the spoke placed in position in the wheel, with the rivet to locate it in relation to the correct hole in the tee-ring. With the spoke just resting in the outer end of the hub-slot, the palm itself must be perfectly flat on the tee-ring, of course (as sketched); if not, the bend must be adjusted one way or the other.

On the hub-centre, the slots do not come square with the oval edge of the hub, of course, and because of this it will be necessary to twist the spoke slightly one way or the other before bending it to fit in the slot. In the sketch the twist is exaggerated; it can be done by gripping the palm in the vice, and using a movable spanner on the other end. This will " spread " the twist, so to speak, along the length of the spoke, as it is in the prototype.

The place for the bend at the inner end may now be marked with a scriber, as in the previous sketch, about 1/32 in. from the edge of the hub, and the bend made as before. It should *not* be square across the spoke, but parallel with the edge of the hub.

Now try the spoke in place again, using the rivet to locate it, of course. You may find it necessary to file the inner end of the spoke slightly at one side in order to get it to lie in the slot; or it may be necessary to adjust one bend or the other, or even the " twist," to get a satisfactory fit.

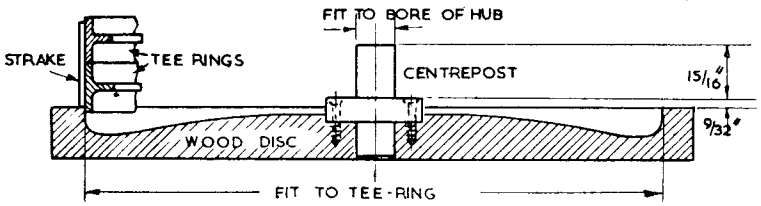
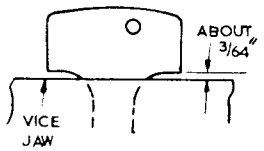
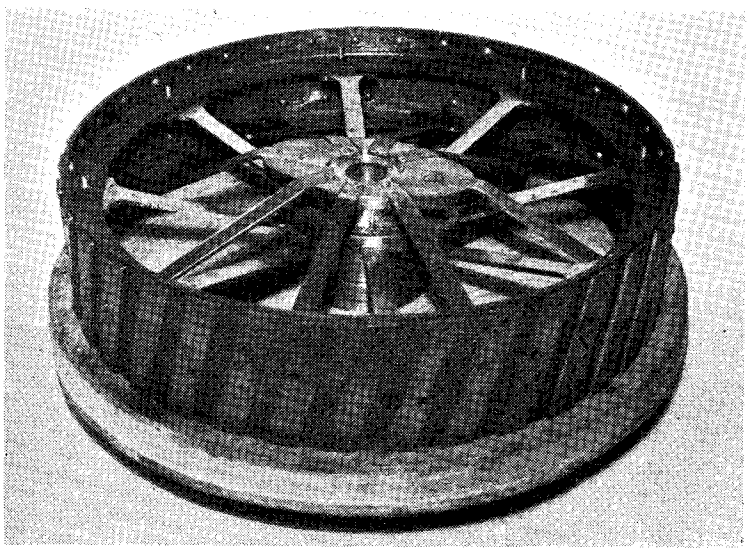


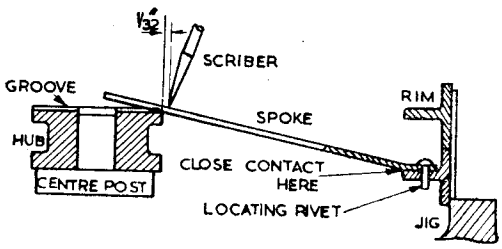

*Diagram of wheel-building jig, with essential dimensions*



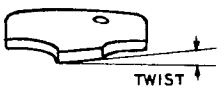

*Spoke-palm ready for bending*



*Photograph No. 69. Second stage in building wheel, with sixteen spokes fitted*




*Marking for inner bend on spoke*




*End view of spoke when twisted (twist exaggerated)*

The principle to aim at is that the spoke lies in place properly on the tee-ring and in the slot, without *any* force being necessary. Otherwise, when it is secured in place by riveting and screwing, it will tend to force the wheel out of true. And if you get *sixteen* spokes exerting pressure, some one way and some the other, there's no telling how much wobble you'll get on the finished wheel !

**Fixing the Spokes**

The inner end of the spoke will probably overhang the bore of the hub, but it is as well to leave on the surplus until the hole for the fixing screw is drilled. We shall use the hole in the spoke as a jig for drilling the tapping-hole in the hub, so see that you centre-pop its position over the " solid " part of the hub; if not, the tapped hole will be in the flange only, and the screw will emerge in the space between the flanges.

Drill the hole No. 42, and countersink it deeply enough for the screw-head to be just below the surface of the spoke. Remove any flash from the back of the hole, put the spoke in position again, and " spot " the hole through into the hub with the same drill. Change the drill for a No. 48, and drill the tapping hole about $\frac{3}{8}$ in. deep, so as to provide plenty of clearance for the end of the tap.

Tap it 8 B.A., and secure the inner end of the spoke with a $\frac{1}{4}$ in. 8 B.A. counter-sunk screw; secure the palm to the rim with a suitable 8-B.A. screw and nut—shape of the head doesn't matter here, since it is only a temporary fixing. The surplus must be cut off the inner end of the spoke first, of course !

When I had fixed the first spoke, the next done was that opposite, and then the two at right-angles followed. In these cases, the three spokes were fitted, and then the three holes in the hubs drilled and tapped subsequently, which saved a little time, perhaps.

I was now anxious to see how truly the wheel revolved, so lifting it off the jig, I placed one of the thick washers or distance-pieces on the centre-post, put the hub back on top of it, and spun the wheel. Eureka, it ran dead true !

Following this, the wheel was replaced properly on the jig, and the other four spokes fitted. On test, the rim again ran true as the wheel revolved. Photograph No. 68 shows the assembly at this stage.

**The Other Side**

To fit the eight spokes on the other side of the wheel, the 17/32-in. thick packing-washer must be used. Place it on the centre-post; then with the hub in position on the latter, the rim should just drop into the outer recess, with the ends of the strakes resting on the surface as before.

On this side, of course, four of the slots *are* square across the flange, and it is logical to fit these spokes first. They are done in the same way as the others, but on the long diameter of the oval, the screws should be so placed as to miss the holes for the wheel driving-pins, which will be drilled at a later stage.

The four remaining spokes are then fitted, and the wheel is ready for fitting the hub end-caps and riveting the spoke-palms to the tee-rings.

To build up the left-hand wheel, exactly the same procedure is followed, except that for the second side we use the packing-washer which is $\frac{9}{16}$ in. thick, instead of the 17/32 in. one. So go ahead, and good luck till next time !

*(To be continued)*

# The 50 c.c. " Bumble Bee "

*(Continued from page 681)*

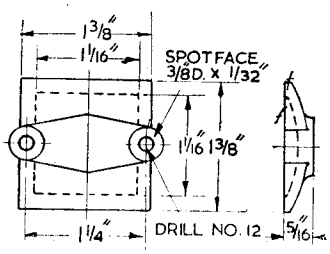
the faces of the eye, as indicated in the drawing, will also improve lubrication.

**Gudgeon-pin**

This is the same as for the " Busy Bee," and should be made of a mild or low alloy-steel and case-hardened —not of silver or carbon steel, either in the soft or hardened condition, as this is too brittle to stand repeated impact stresses. The end pads should be of bronze or aluminium alloy to avoid risk of scoring the cylinder walls. As an alternative, the pin may be located endwise by means of circlips, which are more common in modern practice, but I have found these more difficult to fit, and not by any means as safe as they should be; if one of them should move and foul an inlet port, the result may be disastrous, but a pad will do no harm unless it breaks up, which is very unlikely.

**Transfer Cover**

This requires only to be faced off on the flat side and drilled for the two fixing screws. The joint face may be lapped on a piece of plate glass, and either a metal-to-metal joint or a thin paper gasket may be used.




*Transfer port cover.* (*1 off, alluminium alloy die-casting*)

**Ball-race Retaining Plates**

Either sheet metal or bar material can be used to make these, as they are nothing more than washers, with four countersunk holes in each to take the 4-B.A. holes which secure them to the inside of the bearing housing. Aluminium alloy, such as duralumin, is recommended, but brass or steel will also serve the required purpose.

*(To be continued)*

# QUERIES AND REPLIES

**"THE M.E." FREE ADVICE SERVICE.** Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

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**Engine Turning**

*Will you please advise me of the best method of carrying out engine turning on metal plates, as I have some brass plates which I wish to ornament in this way.*

D.B.C. (Thornaby-on-Tees).

The term "engine turning" is usually taken to mean the engraving of geometric patterns on the face or edge of work turned in the lathe.

Generally speaking, two methods are employed, each of which requires either lathes specially constructed, or a rather elaborate attachment to an ordinary lathe; these are: Either the use of a geometric chuck or a device by means of which the motion of the tool is controlled by means of multiple cams.

If you are interested in taking up this class of work, we suggest that you get in touch with the Society of Ornamental Turners. The secretary is Mr. HAROLD V. YEATMAN, 35, Hoadly Road, Streatham, S.W.16.

**Mercury Pendulum**

*I have recently come into possession of an eight-day long-case clock which is fitted with a stirrup pendulum. This embodies a glass bottle containing a quantity of mercury, and as some of the mercury has evidently been spilt, I am anxious to replace it with a piece of brass tubing containing lead. Please advise me of a suitable weight of lead for this purpose. The length of the pendulum is about 1 metre.*

V.E.U. (Grindleford).

You are no doubt aware that the object of using mercury in the pendulum is to obtain compensation for temperature, as the natural expansion of the complete rod system is balanced by the upward expansion of the mercury in the vessel, so as to maintain a constant position of the centre of gravity relative to the length of the pendulum.

If the mercury is replaced by a brass tube containing lead, the compensation will be affected, as the lead will not have the same coefficient of expansion as mercury. The actual weight of the pendulum has no definite effect on its time-keeping, but will affect to some extent, the load on the driving mechanism of the clock.

Heavy pendulums are desirable to keep the rate of swing fairly constant, but are not suitable for clocks in which the pendulum motion reacts to some extent on the driving mechanism.

We could not advise you of the correct weight of the pendulum without considerably more information on the design of the clock, but if you arrange the lead weight to be approximately the same as that of the mercury, the clock will work efficiently, but time-keeping will be affected to some extent by temperature variation.

**Converting Compression-Ignition Engines**

*I propose to modify my 5 c.c. compression-ignition engine to run on petrol. Can you please inform me where I can obtain:—*

(1) *Drawings and materials for a suitable carburettor to give maximum flexibility.*

(2) *Suitable ignition coil, condenser, contact-breaker and sparking-plug.*

*I assume that if I remove the contra-piston and adjusting screw, and fit the sparking-plug in its place, this will be all the structural alterations necessary to the cylinder-head.*

*I am interested only in flexibility, not performance, as the c.i. engine in its present form is far too powerful for the purpose for which it is required, namely boat propulsion.*

S.B.W. (Horsley, Derbys.).

(1) We do not supply separate drawings of a carburettor which would be of a suitable size for this engine, but the type of carburettor as fitted to the "Seal" or "Seagull" engines could be adapted, and would give quite good flexibility. The drawings of both these engines are obtainable from our publishing department, and are as follows:—

P.E.20 The "Seal" 2 sheets, 5s.
P.E.25 The "Seagull" 2 sheets, 6s.

Castings and materials for these engines can be obtained from Craftsmanship Models Ltd., 27, Circle Gardens, Merton Park, London, S.W.19.

(2) The same firm could supply a suitable coil, condenser, contact-breaker and sparking-plug for the engine.

Removal of the contra-piston, and fitting the sparking-plug in place of the adjusting-screw, will enable the engine to be run on petrol, but it may be necessary to alter the cylinder-head to give a suitable compression ratio for running on petrol with spark ignition. We cannot advise you further on this matter without more detailed information about the engine.

**Torch for Liquid Gas**

*Some time ago an account was published in* THE MODEL ENGINEER *of the testing of a Ferguson Propane Gas heating torch. I am living in the country, where there is no gas supply, and I require a torch for making a 5-in. gauge "Hall" class locomotive. Could you please advise whether the above torch would be suitable for brazing the boiler?*

*I may say that I have two 5-pint blowlamps, which have proved satisfactory for brazing a 1½-in. scale traction engine boiler, but I am doubtful if they are suitable for a 5-in. gauge locomotive boiler.*

S.M.C.T. (Allington).

We are of the opinion that the largest size burner supplied with the Ferguson Propane Torch would be quite suitable for brazing a 5-in. gauge locomotive boiler.

We would, however, point out that a gas torch of this nature is not a substitute for an oxy-acetylene torch in cases where very intense local heat is required. The propane torch, in common with a blowlamp, produces a relatively diffused flame which may generate a greater quantity of heat than the oxy-acetylene torch, but at a lower intensity or temperature. In all cases where a blowlamp or propane torch is used, therefore, the heat is more general, and great care must be taken to conserve heat, by packing the work in coke or asbestos.

We suggest that before you commit yourself to purchasing any equipment of this nature, you should obtain the fullest information from the makers, and if possible see it demonstrated to make sure it will be suitable for your purpose.

# READERS' LETTERS

### MODEL POWER BOAT PONDS

DEAR SIR,—I was very much interested in "Meridian's" article on pages 325-327 in the issue of THE MODEL ENGINEER dated March 25th, 1954, and thank you very much for publishing same.

There is a very fine model power boat pond in Inverleith Park in this city, suitable for both straight running and circular course. Some radio-control enthusiasts with diesel-powered air-sea rescue launches also use the pond, but when it is weedy, they sometimes take their boats to the sea or to other ponds.

The various clubs in the locality often get together in fixing a Saturday or other convenient day which is reserved solely for running model power boats. After years of strenuous effort on the part of members of the sailing and power-boat clubs, improvements are now being made to Inverleith Pond, including the erection of a concrete path with vertical sides in place of the old sloping sides: also, raising the water level to within 4 in. of the path, and keeping the pond free from weeds by the use of chemicals.

The clubs are anxiously awaiting the completion of these improvements so as to arrange their fixture cards.

This pond is the most convenient one in Edinburgh for model boats, though it lies in a low position and has trees and banks nearly all round it.

The photograph shows my steamer *Scotia* at Inverleith Pond. This boat is 5 ft. long by 7½ in. beam, with a displacement of 36 lb., and is radio controlled. The hull is of first-class yellow pine built on the bread-and-butter system, and glued with "Casco" cold water glue. The engine is a "Stuart Sun" ¾ in. bore × ¾ in. stroke, twin-cylinder single-acting, driving a 2¾ in. diameter 7½ pitch propeller. A horizontal feed pump is fitted, ⅛ in. bore, and driven direct off forward end of the crankshaft with no gearing; all water passages are ⅛ in. bore, and a Stuart displacement lubricator is fitted to the steam inlet pipe. Exhaust steam is taken through the bottom of the ship, and condensed in a hollow copper keel.

The boiler is of the centre-flue type in copper, 4 in. diameter, 10 in. long with a 2¼ in. diameter flue, and fourteen ⅜ in. diameter copper tubes arranged in a left-hand spiral. The blowlamp is of the silent type.

I trust that this will be of interest to other model power-boat constructors, and shall be pleased to give further information if required.

Yours faithfully,
Edinburgh. W. M. ROBERTSON.

**Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.**

### STEPHENSON VALVE-GEAR

DEAR SIR,—I was very interested in Mr. R. K. Boardman's article in the April 29th issue of THE MODEL ENGINEER, in which he described the building of a *Maid of Kent* locomotive, particularly so in the reference to the design of the Stephenson valve-gear.

My own *Maid of Kent* (which is finished off as an L. & N.W.R. *George the Fifth*) has Joy gear which notches up well in both forward and reverse, and has a good steam distribution.

I may say that Mr. Boardman is not the first to have trouble with Stephenson gear when the suspension is from one of the link pins; this suspension is satisfactory in the case of shunting engines and traction engines, where practically no notching up is required and the engines always work in full forward or reverse gear.

Some years ago a very satisfactory *Maisie* G.N.R. Atlantic was constructed in this district (Peterborough); she steamed like a witch and would run up and down a short straight track all day. Incidentally, this design has steam ports only 3/32 in. wide, as compared with the usual ⅛ in. in a 3½-in. gauge locomotive; but she always ran in full gear, and no notches were ever cut in the reversing quadrant. If real main-line valve events are required, the suspension of the Stephenson link should be from a point about the centre.

Many years ago, a series of articles appeared in THE MODEL ENGINEER, they were by G. S. Willoughby and dealt very fully with the design of Stephenson valve-gear with launch-type links. These, I am sure, would appeal to all steam engine lovers.

Yours faithfully,
Peterborough. "CHEESEHEAD."

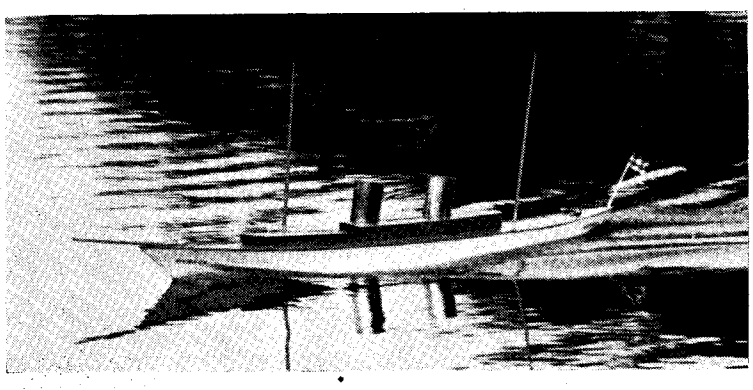
### STEAM ENGINE VALVE TIMING

DEAR SIR,—I have been following with great interest the excellent articles in THE MODEL ENGINEER on utility steam engines, and in particular the details of the "Unicorn Mill Engine" and the "Double Tangye Mill Engine."

There is one small point in the design of both of these engines which has puzzled me.

In both engines the designer has arranged considerable steam lap in the slide-valves—actually 1/16 in. in the case of the "Unicorn" and 1/32 in. in the case of the "Tangye" engine—but no exhaust lap. I haven't had the time to work out the valve diagrams, but this must involve a fair angle of advance, giving early cut-off, with good expansive working, but also inevitably an early release, thus wasting some of the advantages of working expansively.

As you probably know better than I, a small amount of exhaust lap



*Mr. Robertson's 5-ft. model steamer "Scotia" under way on Inverleith pond*

will delay release, giving increased expansion at the expense of an earlier compression. This appears to me to be an advantage as long as the compression is not excessive, because in models the clearance volume is always considerably larger in proportion than on large prototype engines. If there is little compression, this space has to be filled each stroke with live steam, with considerable losses. Also, in large engines, the compression is used to promote smooth running. This reason does not apply to small models, but nevertheless the features should be copied.

It therefore seems to me that a suitable exhaust lap will give greatly improved efficiency, with a slight reduction of overall power. If this reduction is objected to, then why work expansively at all?

I would be very grateful for your readers' views on the above comments.

Yours faithfully,

Rawalpindi, Pakistan. W. P. B. ASHTON, *Brig.*

### FRIENDLY ADVICE FOR "CADET"

DEAR SIR,—I would refer to articles in THE MODEL ENGINEER recently and particularly to the issue of April 22nd last, by a contributor who writes under the *nom de plume* of "Cadet" and heads his articles: "'L' Plates at the Bench." I think it is rather a lack of tact to poke fun at your elders, and his description of his friend "Polonius," seems to lean that way.

Now, the London S.M.E.E. never had, and has not any individual "pillar"; it appoints its own officers and every member is a *part* of that society, not a "pillar." The fact, that this London society is the oldest in the world with the exception of Dublin, and has carried on through two world wars and did not falter, was obviously owing to the fact that it is the "members" and not "pillars" that keep a society afloat.

I have a suspicion that "Cadet's" friend was really "leg-pulling," because wearers of "L" plates have a habit of "sticking their necks out." Then again, before a beginner indulges in criticising the London S.M.E.E. at the inability of its locomotive members to produce new locomotives at each "M.E." Exhibition, he should make a much closer acquaintance of the society and its members by immediately making application to be *allowed* to join. He will then find, that not one of the members posesses in his own workshop a lathe capable of turning the wheels of a 10½-in. gauge express locomotive. The S.M.E.E. possess about eight lathes from watch-maker's size to 6-in. centre.

For "Cadet's" information, I would inform him, that one of our ablest members, who has constructed models which are famous over the whole world, possesses a lathe of only 2½-in. centres, *treadle driven*. A point "Cadet" should bear in mind, is that it is not the most elaborate workshop which produces the finest models; it is the man behind the handles.

I may say I have enjoyed reading "Cadet's" articles, also drawings, and already have a leaning towards his family and dog.

Should "Cadet" and his family be in the neighbourhood of West Wickham at any time, I should be pleased to see them, and show them my workshop, engines, track, etc.

Yours faithfully,

West Wickham. G. W. VICKERAGE.

### WEBB'S WATER BRAKES

DEAR SIR,—With reference to the correspondence regarding Webb's so-called "water brakes," the following may be of interest:—

I have in my possession photostat copies of an article in the paper *Engineer*, dated December 21st, 1877, describing and illustrating the L. & N.W.Rly. locomotive, No. 2000, a 2-4-0 tank; in the text, the following passage occurs: "Another feature is the hydraulic brake . . . the brake cylinder is of cast-iron, 9 in. in diameter, the stroke being 9 in. The piston and rod are forged in one piece. On the top of the piston is a steel plate, ½ in. thick, and bolted to it by six countersunk bolts; by taking off this plate, the piston can be repacked without removing it from the cylinder. From the top of the cylinder is a copper pipe leading to a three way cock attached to the whistle stand on the firebox, this pipe supplies the cylinder with steam when the brake is off. A similar pipe leading from the bottom of the cylinder to a cock fixed on the firebox below the footplate conveys water to the cylinder, and forces up the piston when the brake is to be used.

"The brake is applied by moving the handle of the three way cock from one side of the quadrant to the other; this operation closes the passage from the boiler, and opens one from the cylinder to the tank, thus allowing the steam to escape. Immediately the pressure is removed from the top side the piston is forced up by water under full boiler pressure. To release the brake the handle of the cock is moved in the opposite direction, when steam is admitted to the top of the cylinder, and acting on the greater area the piston is forced to the bottom.

"Mr. Webb has now made forty engines of the type we have been describing. . . . The performance of the engines has been most satisfactory."

This obviously describes a brake intended to overcome the trouble caused by the condensation of the steam entering a cold cylinder, and the drawings indicate that it was an engine brake only, as there is no trace of any connection to the train, nor is there any mention of such. It was stated to be very "prompt and effective." The article describes the brake rigging connecting the brake cylinder to the enormous wooden brake blocks on the coupled wheels.

One of these engines had at the time that the article was written, run for over 29,000 miles, showing that the idea was practicable, and not, as Mr. Nicholls suggests, confined to one engine, and full of snags.

Yours faithfully,

London, N.7. M. EDWIN MOON.

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